Lima, April 7, 1986

Dr. Fernando Chaparro
Director of the Regional Office for
Latin Americ and the Caribbean
International Development Research Center
A.A. 53016
Bogotá, D.E., Colombia

Dear Dr. Chaparro:

According to the terms of my Consulting Contract with the IDRC, signed on December 11, 1985, I am happy to send you with this letter the final report of my study, entitled "Evaluation of Agricultural Research in Peru"

Following the suggestions of the Consulting Contract, the study is made up of eight sections:

I. Introduction
II. Agriculture and Research: Present Situation
III. Description of Institutional and Operational Mechanisms Employed by NIARP for Evaluation of Agricultural Research
IV. Other Institutional Experiences
V. Characterization of the NIARP Experience in Evaluation of Agricultural Research
VI. Description and Analysis of Principal Internal and External Evaluation Studies Developed by (and for) NIARP
VII. Analysis of the Situation: Principal Conclusions and Results
VIII. Recommendations

At the end of the study, there is a Bibliography. The eight sections mentioned are supported by 11 Appendices, which form an integral part of the study. With my accompnaying letter of January 15, 1986, as part of the Advance Report, I sent the seven first Appendices, and now I am sending the last four Appendices, which are:

Appendix 8: Historical Review of Agricultural Research in Peru to 1980, which I just finished in March, 1986.

Appendix 9: Methodology for Calculation of Costs and Yields under Inflationary Conditions and for Risk Analysis and Comparison of Agricultural Technologies. NIARP Economic Notes, No, 06-84.

Appendix 10: Preparation of Investment Projects at the Farm Level, NIARP Economic Notes, No. 08-85.

Appendix 11: Reviewing Agricultural Research Systems, prepared by G.W.. Norton.

I hope that I have fulfilled the terms of the Consulting Contract. However, I am at your service for any additional consultation or clarification with respect to the Study. Finally, Dr. Chaparro, please allow me to manifest my special satisfaction and thanks to you and the IDRC for having offered me the opportunity to carry out this study and to participate indirectly in the important regional study on the evaluation of agricultural research.

I send you my most cordial greetings,

VICTOR PALMA

EVALUATION OF AGRICULTURAL RESEARCH IN PERU[1]

BY Victor Palma[2]

---

1) Study prepared for the International Development Research Center - IDRC

2) Agricultural engineer, M.s., Ph. D.

EVALUATION OF AGRICULTURAL RESEARCH IN PERU

Table of Contents

I. INTRODUCTION

Investment in agricultural research in many developed and developing countries has increased notably, especially in the last twenty years. In addition to strengthening national institutes for agricultural research with respect to their human, physical and financial resources, international institutions for finance and philanthrophy have established a network of International Centers for Agriculutral Research. In general, society has decided to channel a larger amount of resources to agricultural research instead of to research in other sectors of the economy.

Possibly due to imitation of foreign models, many developing nations increased their investment in agricultural research in real terms only after having invested in agricultural extension for many years. The hypothesis was that there already were two fundamental elements for agricultural extension: 1) human resources for research and extension would be sufficiently prepared and trained to act efficiently; 2) agricultural research would have generated the necessary and sufficient technological knowledge for its accumulation and storage, which would permit its divulgation on a large scale. Unfortunately, the small

relative success (and in some cases, outright failure) of extension programs in the decades of the fifties and sixties proved that the hypothesis was mistaken. When the developed countries proved and accepted their error, they modified their policies for resource assignation and began to invest in agricultural education and research at real rates of growth. Since public funds are generally insufficient for the demands of research, a mechanism is required for the distribution of them among the diverse investment alternatives available. Therefore, agricultural research, like any other economic activity, must compete for resources with other programs or projects financed by public funds. When this occurs, seveal questions arise: Is it worthwhile to invest in thse activities? If so, how much should be invested, where and for how long? What are the social and economic benefits of these investments for society? In order to answer these questions, many studies have been made around the world, since the end of the decade of the fifties. In summary, there are three fundamental aspects to the studies: socio-economic evaluation of agricultural research; assignation of resources to (and within) agricultural research; the contribution of research to agricultural development and economic growth.

In this introductory section, it is also necessary to make an important clarification. Upon reviewing the literature extant on the subject, there is a separation between methods and research evaluation studies, education and agricultural extension, which is evidently quite arbitrary. Really, there is a great interrelation between research, education and extension. There cannot be a good research program without well- trained researchers, who have the theoretical bases and are oriented toward solving the practical problems of agriculture and farmers. Nor can there be a good educational program without trained professors or based only on theoretical aspects which have insufficient empirical proof in the specific environment and in the socio-economic conditions in which the educational program takes place. There cannot be a good extension program without trained professionals and without a permanent flow of technological knowledge , allowing for a continual flow of up-to-date information in the process of dissemination. What actually occurs in the majority of evaluation methods and studies is that the effects of each variable cannot be separated. The majority of studies seeking to evaluate the returns of agricultural research implicitly include returns to education and extension. The few studies which have attempted to separate the direct returns to agricultural research, such as Sunquist, et.

al.(1981) and EMBRAPA (1982) had to do so subjectively. Precisely because of the lack of sufficient theoretical instuments, the majority of studies attribute the total benefits to research, when due to the interrelationships existing between the three variables, part of the benefits should also be attributed to education and agricultural extension. This explanation (considering only the costs of research with respect to the total benefits) might be one of the reasons for the high rates of return found by the majority of the studies designed and used to evaluate agricultural research. But the high rates of social return in investments in agricultural research might also be an indication that those investments have been showing a yield below the optimum level.

In referance to agriculture and programs of agricultural research, the Peruvian case is particularly clear. Peru has an agricultural bases of only three million hectares cultivated annually (among which are permanent crops, grasslands and cultivated forests) and a total population of approximately twenty million. Today it has a relation of land per capita of 0.15, which is one of the lowest in the world. In 1980, FAO estimated an average of 0.33 for the world. In addition, it is estimated that

the area cultivated in Peru will not increase significantly in the next fifteen or twenty years, and that at any rate the increases shown will be offset by the land that becomes improductive due to the effects of salinization, erosion, desertification, natural disasters, etc. But it is also estimated that between the years 2000 and 2005, the total population of Peru will have reached 30 million, which would mean a relation of land per capita of 0.10 to 0.11 at that time. Therefore, with serious limitations to the expansion of cultivated land, a growing consumer population principally in the urban sector (given the high rates of rural-urban migration observed in the past and present, and which show every indication of continuing at high rates for the next 10 to 20 years) and with a production base which in the best of cases will remain constant in the coming decades, it is evident that Peruvian agriculture needs to seek rapid technification which will permit rapid growth of productivity in its production factors and increased technical and economic efficiency in production.

The diverse internal and external evaluation studies presented in this paper show the existence of clear evidence that in the 1980-1985 period there was great effort on the part of the public sector to support and carry out agricultural research, education and extension policies in Peru.

In some aspects, government efforts were oriented to the revival of heyday of the national system, which took place between the end of the fifties and the beginning of the decade of the seventies. The effort of the public sector has been shown by the enormous group of mechanisms and activities which have led to the creation and functioning of a national, informal system of research, education and extension in Peru. Leadership in this area is jointly exercised by the National Institute for Agricultural Research and Promotion (NIARP) and the National Agrarian University (NAU).

The objective of the study is to describe and analyze the Peruvian experience in the evaluation of agriculutral research, with special emphasis on the NIARP experience. It is hoped that with the description and analysis carried out, the economic, social and political payoffs of the efforts of the public sector - with the support of international institutions with respect to financing, donations and technical assistance- might be verified.

The study begins by describing agriculture in Peru and the national system of agricultural research, NIARP research programs and its research

resources. In the following section, the study describes the institutional and operational mechanisms used by NIARP for research evaluation, as well as describing its internal organization and its system for research planning. In Section IV, the experiences in research evaluation in other institutions is presented, although the literature available on the topic is quite limited. Section V presents the characteristics of NIARP's experience in research evaluation, which is done in terms of the type of evaluation, and who, how, when and at what level the evaluation is made. The characterization is also made in terms of internal and external evaluations. Section V is the framework for Section VI, which presents a description and analysis of the principal research evaluation studies - internal and external - developed by (and for) NIARP. Before presenting the principal conclusions and results of the study, Section VII makes a comparative analysis of the policies of agricultural expansion, increased productivity and relative participation of the private and public sectors in agricultural reseach activities in Peru. Finally, Section VIII presents a group of recommendations in order to contribute to the improvement of the present mechanisms for internal and external research evaluation in Peruvian agriculture.

II. AGRICULTURE AND RESEARCH: PRESENT SITUATION

1. Antecedents

The total area of Peru is approximately 1.3 million square kilometers, divided in three markedly different regions - the coast, the highlands and the jungle. The jungle region can be divided into the jungle piedmont and jungle regions.

Of an estimated total of 7.6 million hectares suitable for agriculture, there are approximately 3.2 million hectares presently cultivated. Nearly 18 million hectares are appropriate for grass production and nearly 50 million for forest production. There are 1.2 million hectares irrigated, 0.8 million in the coast and 0.4 million in the highlands. The coastal areas farmed are quite well managed and their yields are relatively high. The area dedicated to crops for dry land includes nearly 1.5 million hectares in the highlands and 0.5 million hectares in the jungle (mostly in the jungle piedmont).

Of a total population of 19.7 million in 1985, 48% live in the coastal region, 42% in the highlands and only 10% in the jungle. Nearly 7.2 mil-

lion people make their living from agriculture. As in the majority of developing nations, the predominant demographic group is that made up of ages 0 to 14, a total of 40% to 45% of the total population.

The concentration of land in large ranches led the government to initiate a program of agrarian reform, to which it dedicated the majority of resources earmarked for agriculture from the end of the decade of the sixties to the end of the seventies. Production cooperatives and other associative forms of production were created, and in many cases the size of individual holdings was restricted. The agrarian reform has its greatest impact on the coast and the large ranches of the highlands. The problems of the subsistence farmers in the highlands continued without solutions. Problems of organization and management brought about the process of parceling the land belonging to the cooperatives in recent years, creating individual production units, leaving the cooperatives with certain service functions. The process is still in evolution. During the process of agrarian reform, the majority of agricultural activities were strongly influenced by the public sector, through planning and control. Support services (raw materials, credit and commercialiation) were provided mainly by state enterprises. As part of this general pano-

rama, the private sector invested very little in agriculture. In addition to being decapitalized, agriculture had lost its profitability.

Agriculture's contribution to the Gross National Product was reduced to nearly half between 1950 and 1980. Since then, it has remained stable and now provides between 11% and 13% of the GNP. But almost one of every three Peruvians makes his living directly from agriculture and produces the greater share of the food consumed by the total public. Per-capita agricultural production has fallen consistently since 1974.

During the period from 1968 to 1980, support for research and extension decreased and institutional capacity for offering these services also decreased, losing much of its effectiveness. Many well-trained professionals left public institutions and the country, as well (See Appendix 8).

2. Structure of the National Research System

The increased agricultural production in Peru before 1950 depended on the increase of land cultivated, as occured in the majority of developing nations (horizontal growth). In 1940, special emphasis was given to extension service, but the effort was not very productive since there

was not the the necessary technology to be transferred to the farmer. In the decade of the fifties, the use of improved technology as a manner of increasing productivity was considered, in order to achieve "vertical" growth in agriculture. However, Peru has had difficulties in beginning and maintaining a flow of improved technology, which is essential to scientifically-based agriculture. Frequent reorganizations of the research and extension systems, the lack of integration of experienced researchers in the National Agrarian University (NAU) and the lack of permanent monetary support for research have been, and continue to be, the principal reasons for difficulties.

The flow of improved technology is one of the three essential elements for increasing productivity and agricultural production. The others are motivation to produce more, in a more efficient manner, and a stable, effective system of commercialiation. The national system for agricultural research and extension is responsible for the generation and diffusion of improved technology; NIARP is an important part of that system.

Needs with respect to research, extension and other related services should be considered in the framework of the country's economic and financial problems, the need to increase food production, the relatively low pro-

productivity of the majority of crops, the existence of a new system of landholding which produced many new farmers, and the depression in the research and extension systems which took place in the decade from 1968 to 1978. Present research programs should efficiently use all the talent available in order to achieve results which can be rapidly used, limit themselves to the most urgent needs, increase productivity as rapidly as possible and provide clear evidence that investment in research produces high dividends.

2.1 NIARP

The National Institute for Agricultural Research and Promotion (NIARP) was created in 1981, and was made responsible for planning, directing, conducting, supervising and evaluation agricultural research, extension and services, as well as mechanization services and rural commercialization activities. None of these functions were new, and NIARP inheirited the personnel and, to a great extent, the organization and operative habits of several public institutions, especially the National Institute for Agrarian Research (NIAR) and the Extension Service of the General Directorate of Agriculture and Livestock, Ministry of Food and Agriculture.

NIARP field personnel is distributed in twenty Agricultural Research and Promotion Centers (ARPC). The jurisdictions of the ARPCs correspond to a great extent to the limits of the departments (provinces). The ARPC directors supervise research activities, as well as extension services ; they report directly to the Chief of the NIARP. The directors of the experimental stations and of the diverse promotion zones report to the executive directors of research and promotion, respectively, Planning of national programs by products is guided by the program leaders, but program execution is supervised by the ARPC director.

2.1.1 Research

Research in NIARP is carried out in experimental stations and substations, as well as in parcels belonging to individual far ers. Twenty-five locations have been chosen to develop experimental stations, and an additional 38 have been chosen for substations (Table No. 1). There are six well-developed experimental stations. Table No. 2 shows the regional distribution of the structure for agricultural research. The highlands have 44% of the total number of experimental stations and 42% of the experimental substations. Most of the research in the experimental stations is part of the product programs, but part also responds to local needs.

NIARP has good relations with a large number of foreign institutions, which are sources of scientific information and of materials which can be tested in Peru. Relations with the International Centers for Agricultural Research are well-developed and provide a constant flow of knowledge and experimental material. Likewise, the NIARP works in two cooperative research projects (tropical soils and lesser ruminants) with several American universities and other countries participating in the programs.

Both the International Centers and the cooperative programs provide information and experimental material. NIARP, in addition to using the results, participates and assists in planning and implementation of research projects. Many developing nations benefit from these international projects in collaboration with the NIARP.

Table No. 1 NIARP. Structure of Agricultural Research by ARPC

ARPC	Experimental Stations	Experimental Sub-stations	Experimental Fields
I- Piura	1	2	1
II-Chiclayo	1	-	-
III-Trujillo	2	3	3
IV - Huaraz	1	1	-
V - Lima	1	3	-
VI -Ica	2	-	3
VII - Arequipa	1	6	2
VIII - Tacna	1	2	2
IX - Cajamarca	1	3	-
X - Moyebamba	2	3	-
XI - Huanuco	2	4	-
XII - Huancayo	1	1	-
XIII - Ayacucho	1	2	-
XIV - Cuzco	2	4	3
XV - Puno	2	2	-
XVI - Iquitos	2	-	3
XVII - Madre De Dios	1	1	-
XVIII - Pucallpa	1	1	-
TOTAL	25	38	17

Source: NIARP, Guide to the Organic and Functional Structure of the NIARP at the Central and Regional Levels, Sixth Edition, January, 1985.

Table No. 2 NIARP. Regional Structure of Ahricultural Research

Region	Experimental Stations	Experimental Sub-stations	Experimental Fields
Coast	7	12	9
Highland	11	16	4
Jungle	7	10	4
TOTAL	25	38	17

Source: NIARP, Guide to the Organic and Functional Structure of the NIARP at the Central and Regional Levels, Sixth Edition, January, 1985.

2.1.2 Promotion

The Executive Directorate for Agricultural Promotion (EDAP), NIARP, has three types of activities: agricultural extension, social promotion and provision of services. The principal objective is to provide technical assistance to owners of parcels from 1 to 20 hectares in size. This group of farmers represents 800,000 production units and a total cultivated area of 2 million hectares. The majority of these producers are located in the highlands. The extension service is responsible for disseminating the technology generated through research, and the services it provides are to facilitate the adoption and use of technology by farmers producing directly for the market.

The extension activities at the NIARP are organized in each of the ARPCs. The ARPCs are divided in one or more Agricultural Promotion Zones. Each zone is made up of several Extension Agencies, which, in turn, are divided into Sectors. At the national level, there are 40 Agricultural Promotion Zones, 239 Extension Agencies and 929 Sectors. The extension specialists in each zone test new technologies at the production unit level. At the agency level, the sector personnel are the main link to the farmers, making regular visits every two weeks to the participating

farmers. This system, known as Training and Visitation (T & V), has been modified according to local necessities. Some commercial organizations, as well as other private agencies, also do extension work, especially in the coastal region.

The NARP has combined the approach used by the agricultural research and promotion with other extension methods (T&V, systematic diagnosis and planning). By means of this system, the farmer receives specific information. The system applied is the use of conventional methods such as audio-visual material and field demonstrations.

From the technical point of view, the link between research and extension is made by means of:

a) experimental field parcels, which are the main responsibility of research, with the participation of extension services.

b) field testing parcels, which are the shared responsibility of research and extension.

c) demonstration parcels, which are the main responsibility of extension, with the participation of research. This system provides good technical links through fieldwork. The technological package focus has bee used in these tests.

The NIARP also provides mechanization services. The National Agricultural Machine Service (SEMAMA) was inheirited by NAIRP and continues to operate autonomously. To present, SEMAMA has been able to cover its operation costs, including the cost of personnel, by charging for its services, but this does not cover the cost of depreciation. The amount charged for tractor service - with implements - is half the real cost, but it is compensated, up to a point, by the more realistic costs charged for heavy machine service.

2.2 The University System

The university system includes the National Agrarian Univeristy (NAU) and the agricultural colleges of several provincial universities. They offer a degree in agriculture, with no specialization available. The NAU offers a similar degree, but the students must develop a certain degree specialization, in addition to preparing and defending a thesis, in order to receive the degree of Agricultural Engineer. The University of the Pacific offers a program in agricultural economics. The National University of San Marcos offers degrees in veterinary medicine and livestock production, without specialization. Fourteen universities have departments of agronomy, veterinary medicine and livestock production.

The NAU has eight colleges, and all require research programs. The professors carry out on-campus research and in various institutes located in key sites throughout the nation. Of 380 professors, 114 have master's degrees and 51 have doctorates. The College of Agronomy is made up of 68 professionals, 34 with master's degrees, 31 with doctorates and 3 agricultural engineers. The NAU offers master's degrees in fifteen specialities, but does not offer doctorates.

Professors at the NAU have been involved in research programs for a long time and, to a lesser degree, in extension services. Ususally professors teach eight hours of class a week and therefore have time for research but they must generally seek outside resources in order to carry it out. The most productive research programs at the NAU have been those related to barley, wheat, potato, forage, cotton, corn, quinine and native fruits. Some extension work is done by professors who are working on research, through whatever mechanism might be available, including those in the private sector.

2.3 Other Research Institutions

Some Special Development Projects, carried out by the National Development

Institute (INADE) also support research. Seven jungle development project agreements have been signed with the NAIRP. In some cases, the Project may finance NAIRP operations, while in other cases, Project personnel carry out the research.

Other institutions that carry out research programs are: the National Institute for Agro-industrial Development (NIAD), Institute for Increased Agricultural Acreage (IIAA), National Institute for Forests and Fauna (NIFF), Institute for Research in the Peruvian Amazon (IRPA), and the Veterinary Institute for Highland and Tropical Research (VIHTR).

2.4 The Private Sector

The private sector has also participated in research activities. In 1926, the National Agrarian Society, which was a farmer's association, established an experimental station in La Molina. In the same year, the farmer's association in the Canete Valley founded an experimental station dedicated to cotton research. A year later, the association decided to establish a fee of US 20¢ for each sack of cotton produced , in order to support research. In 1948, this voluntary fee was increased to US $2.50 per sack. This was the first experimental station totally financed by a farmer's association. In 1972, the association was dissolved, and with

it, the four experimental stations established in Canete, Ica, Piura and Jequetepeque (See Appendix 8).

Another private organization that contributes to research is the Foundation for Cotton Development (FUNDEAL). Since 1970, the Foundation has supported research in cotton through agreements with the associations in Ica, Canete, Huacho and Piura. The Foundation obtains its resources from a contribution of $0.21 soles for sack of cotton produced.

In the past sugar cane research was carried out by the large ranches as a part of their regular operations, and there were several well-known experimental stations, such as those at Cartavio, Tuman and Paramonga. During the agrarian reform, the Central Institute for Sugar Cane Research was created to serve the 12 large sugar cane cooperatives. There is also the Peruvian Sugar Institute, in Trujillo, which is dedicated to industrial research.

3. NIARP Research Programs

Toward the end of 1985, NIARP agricultural research and promotion programs had been organized on the basis of National and Regional Programs, Re-

gional Support Services and a group of diversified Programs. There are ten National Programs (six National Product Programs, two National Production Systems Programs, and two National Support Programs). The National Product Programs include the following: Rice, Corn, Potato, Cereals, Granular Legumes and Livestock (this last program includes animal species, grasses, forage and the Support Program for research in lesser ruminants).

The National Production Systems Programs include the Andean Agricultural Systems Program and the Agricultural Research and Promotion in the Jungle program. The National Support Programs include the National Agroeconomic Program and the National Program for the Development of Human Resources (NAIRP). The National Support Services are: Laboratories, Quantitative Methods and Analysis, Artificial Insemination, Seeds and Agricultural Machinery. The Regional Programs include Vegetables, Fruits, Industrial Crops, Tubers and Roots, Granular Sorghum and Entomology. The diversified Programs include Tropical Soils, Cheese-making, Control of the Mediterranean Fly and the Amazon Agroecological Research Network.

3.1 National Product Programs

Toward the end of 1982, the planning for five National Product Programs was reaching its final stages; planning ended in 1983. The Programs have

been in the process of implementation since mid-1983. Each National Program is directed by a Peruvian scientist (National Program Leader) and by a foreign scientist of international reputation, who acts as Co-Leader of the Program and belongs to the technical personnel of the International Potato Center - CIP, to the International Center for Tropical Agriculture - CIAT, or to the International Center for Improvement of Corn and Wheat- CIMMYT.

Research and extension personnel were assigned to each program; they are based in the important Experimental Stations. In addition, other sites are designated from Program research and extension activities. All administrative Program activities, both at the central offices and the secondary locations are carried out through the ARPCs and the NIARP central office. This organization and structure, together with the strategy of cincentrating investment in a group of National Programs of high priority for national agriculture,have permitted a relatively rapid implementation of physical resources, although human resources have perhaps been less rapidly mobilized in research and agricultural promotion. The central offices of the National Programs have been rennovated and reequipped for research and extension. Some secondary locations have also benefitted in the same manner. The implementation mentioned includes

provision of services such as water and drainage, repairs in some buildings and construction of others, equipping or re-equipping of laboratories, acquisition of machines and other equipment for research and agricultural promotion, the implementation of a transport fleet for research and, principally, extension services, and the repair and/or construction of facilities needed for agricultural extension. In addition, there have been great investments in the training of human resources through formal programs at the master's level, in addition to continuing education programs. The National Product Programs include:

1) National Rice Program

For the coastal region, the Office of the National Rice Program is located in the Experimental Station at Vista Florida in Chiclayo, Lambayeque Department; for the upper jungle region, the office is located in the El Porvenir Experimental Station, near the city of Tarapoto, department of San Martin. In addition to these two offices, six other secondary sites have been designated to support program research and extension in the coastal region and the upper jungle. The National Rice Program's research team is made up of 25 professionals, while its extension program has 68 professionals located in the principal rice-producing areas in the country. The strong ties of cooperation with CIAT have permitted an exchange of seroplasm, which is continually evaluated in various localities.

There are also several research professors from the Pedro Ruiz Gallo University in Lambayeque who contribute to the National Rice Program. Joint activities with the Tropical Soils Program , located in Yurimaguas, have led to permission to use the San Ramon Experimental Station as an important center for experimentation and dissemination of rice technology in the lower jungle region.

The priorities of the Program, which are common to all the National Product Programs, include the selection of varieties which have greater productivity and resistance to seroplasm, as well as other agronomic aspects, fertility, weed control, bio-climatological aspects, plague and disease control, etc. In the coastal region, research has concentrated on saline aspects, precocity and quality. Improved seeds of new varieties have been developed; they have a shorter vegetative period and yields of nine to eleven tons per hectare, In the jungle region, where the viability of having two crops per year has been determined, the priorities have centered upon the selection of varieties, mechanical planting, weed control, mechanical harvest and improved quality. In addition, it has contributed to the solution of the chronic labor shortage in the region. There is both experimental and empirical evidence that direct sowing with low-cost equipment and mechanical harvest have both had high rates of

technological adoption. Information from CIAT has permitted the verification of increases in production and productivity in the Peruvian jungle; they have been really impressive. Between 1982 and 1984, it has been estimated that in just two sub-regions of the jungle (Alto Mayo and Huallaga Central), rice production has increased from 40,000 to 85,000 tons, due to the increased area under cultivation and to increased yields of hectare per year. In 1987, the production is expected to be 270,000 tons in the two sub-regions.

2) National Corn Program

There are two offices for this National Program: the Office for Research and Promotion of Sweet Corn is located in Cajamarca, while the Office for the Hard Yellow Corn Program is located at the El Porvenir Experimental Station in the San Martin Department. As part of the National System, and as support to the Program Offices, 16 secondary sites are used in the jungle and 15 secondary sites are found in the highlands. The professional personnel of the Corn Research Program is made up of 40 full-time researchers.

NAIRP's National Corn Program maintains str ng cooperative relations with

CIMMYT, which provides a continuous flow of seroplasm, principally for hard yellow corn, and training programs in both Peru and Mexico. Each time a new variety is introduced, its agronomic characteristics, fertilizing recommendations, planting and harvesting times, sowing density and methods for weed control are given.

3) National Potato Program

The central office for the National Potato Program is located in Huancayo. There are important branch offices in La Molina, Cusco and Cajamarca, and 20 secondary locations for research and extension activities. The Program has more than 50 full-time researchers and more than 53 extension agents distributed in the greatest production zones throughout the country. The central objective of the program is to select varieties resistant to Phytophora infestans and Globodera rostochiensis. Another important objective of the Program is to find material tolerant of freezing temperatures, associated with precocity. The adaptation of new methodologies to produce potatoes free of virus has led to the recommendation of certain varieties which have been subjected to an extensive multiplication program, since they can substantially increase yields. In this sense, the close relationship between the National Po

tato Program and the International Potato Center, whose main office is in Lima, has been very important. There are also good cooperative relations with the professors at the NAU. There are also good relations between the research personnel and the extension personnel of the National Program itself; in this aspect, the Potato Program is an example for the other National Programs. Finally, the Program is a good example of the coordination that should exist among the various participants. An example of this is the collaboration offered by Swiss Technical Cooperation, in order to provide technical assistance and operational support for the development of a production program for potato seed free of virus.

4) National Cereals Program

The main office of the National Cereals Program is located at the Andenes Experimental Station in the Cusco Department, although it also operates in 21 secondary locations, in the highlands and along the coast, including the Departments of Puno, Ayacucho, Junin, Huanuco, Cajamarca, Tacna, Arequipa, Lima, Ica, Ancash, La Libertad and Piura. More than 100 professionals, including more than 50 researchers and more than 50 extension agents work for the National Cereals Program. The products

that the Program works with are wheat, barley, oats and triticale, although the Programs major priority is wheat. Other important elements of the Program include collaboration with other institutions. There are several cooperative activities underway with the National Agrarian University, trhough its National Cereals Program, as well as with the International Center for the Improvement of Corn and Wheat (CIMMYT), which besides assigning the Co-Leader to the National Program, is a constant source of genetic material to be evaluated in Peru and of training for the Program professionals. The National Cereals Program also receives strong technical and financial assistance from the Canadian government.

The main objective of the Program has been the selection of varieties adapted to the specific characteristics of each locality, resistance to disease and the limitations of the regional ecosystems, agronomic practices, seed multiplication and grain quality. The Program has also developed activities in soil fertility, spacing and weed control, which are all quite specific to a given geographic locality. This evidently requires a great effort of the part of extension activities, principally through demonstration field activities which are jointly implemented with the National Program for Andean Agricultural Systems. The Program has already identified a promising group of varieties of wheat, barley,

oats and triticale , which are being multiplied in 55 locations throughout the country. The Program is also multiplying improved seeds in 18 locations in the highlands and on the coast.

5) National Program for Granualr Legumes

The main office of this National Program is located in the Department of Ica. The national research and promotion network is made up of 5 sites on the coast, 39 in the highlands and 3 in the jungle. Nearly 50 professionals are dedicated to research activities in the Program and more than 70 professionals carry out full-time extension activities in the Program. At the national level, working relations have been established with the National Agrarian University and 6 regional universities; at the international level, the relationship with the International Center for Tropical Agriculture has been very close, since it assigns the Co-Leader to the National Program. It is also a source of continuous supply of seroplasm for granular legumes, especially beans, as well of training in Peru and Colombia. The National Program for Granular Legumes works with diverse products, including beans, soybeans, cowpeas, peanuts, lima beans, fava beans, and more recently, tarwi. . Despite this great diversity of products, the Program concentrates primarily on beans.

6) National Livestock Program

The National Livestock Program was structured and implemented nearly two years after the other Programs mentioned previously. From the end of 1982 to the beginning of 1983, the NAIRP had decided to concentrate its efforts on the five National Programs and not to begin any more until the first five began to show results. Since the results became obvious beginning in 1984, and to satisfy a growing demand, having observed the chronic deficits that exist with respect to livestock products on a national level, NAIRP decided, at the end of 1984, to write the Basic Document for the National Livestock Program. The elaboration of the Program made use of the services of a number of national and international consultants: the National Agrarian University, The National University of San Marcos, through the VIHTR, A.I.I, F.A.O., C.I.A.T., the International Center for Cattle Development and Research at Winrock, the mission from North Carolina State University, the International Development Research Center of Canada and the University of California at Davis, which supported the Cooperative Support Program for Research in Lesser Ruminants. At the end of 1984 and the beginning of 1985, NAIRP livestock research and promotion activities have been directed toward the structural consolidation of the National Livestock Program, based on the activities

of the ARPCs and the of the Cooperative Support Program for Research in Lesser Ruminants. Activities underway include: 1)Characterization of livestock production systems. Its objective is to define national livestock production, identify limiting factors and, based on this information, prioritize research and promotional activities. At the national level, fifteen systems have been characterized (5 on the coast, 6 in the highlands and 4 in the jungle). Microregional work is being done in the Departments of Piura and Lambayeque on the northern coast, Junin and Pasco in the central highlands and Cusco and Puno in the southern highlands. 2) evaluation, management and improvement of nutritional resources. Studies have been made of the botannical, physiological and autoecological composition of natural grasses. Studies are also being made of the management of natural grasslands, in order to determine the capacity and optimum pasturing systems. In the southern highlands, based on the results of the PIARP and New Zealand government project, the natural grasslands have been continually enriched by the introduction of red, white and hybrid clover, in addition to selected varieties of alfalfa. In the jungle, evaluation and production of the seed of Anaroposon gayanus is underway. 3) genetic evaluation and improvement. Studies are being carried out to evaluate the genetic resources available in different species of livestock. The evaluation included exotic species introduced

and adapted to the environment, as well as the local species or types. This activity is being carried out with bovines, ovines and alpacas. 4) in the Cooperative Support Program for Research in Lesser Ruminants, evaluation of the productive potential of native and improved species in ovines and alpacas is being continued, In addition,seasonal variations in the ovulatory rate of ovines is being studied. On the northern coast, the reproductive performance of goats is being evaluated. With respect to sanitation, the prevalence of infeccio-contagious and parasitical diseases is being analyzed for ovines and alpacas. 5) socio-economic analysis of livestock systems. The effects of a communal system of land-holding on the use of natural grasses and the interaction of crops and stock at the family unit level is being studied. 6) home raising of lesser species. In this area, the major effort is directed toward family raising of guinea pigs, Tests of genetic selection of varieties with high growth rates and high yield are continuing, with promising results.

3.2 National Production Systems Programs

In 1984, the NAIRP created and consolidated two Regional Programs, called National Production Systems Programs.

1) Andean Agricultural Systems Program

This National Program carries out its activities in the Departments of Cajamarca, Ancash, Junin, Cusco and Puno. Various diagnostic studies have been made at the level of Andean communities and more than ten training activities have taken place. More than 60 experiments in Andean crops and native grasses have been established. A great effort is being made to collect and evaluate genetic material of Andean origin, such as quinua, tarwi, quiwicha, oca, olluco and mashua. The Program has more than 20 researchers in various disciplines and more than 50 professionals doing extension work. The Program has begun to select and study the agronomic characteristics of 27 Andean crops and 17 species of grass and forage. It is equally important to point out that the Program maintains relations with the National Product Programs that are developing appropriate technologies for the Andean region, especially with the National Programs in the areas of Potato, Corn, Cereals and Granular Legumes.

2) Agricultural Research and Promotion in the Jungle

This National Program, approved in 1984, began activities in 1985. The principal objective is to integrate agricultural research and promotion

efforts in the Peruvian jungle, including those carried out by the NAIRP, as well as those of other institutions. The Program also has other objectives, such as increasing the production of foodstuffs and forest products, reducing the indiscriminate destruction of forests by establishing different systems of land use, regenerating productivity of soils in degraded ecosystems, promoting the improvement of transportation, credit and commercialization systems for agricultural products, and encouraging double-use cattle-raising in the region. The Program site is Iquitos, but there are additional locations that participate in the Program, such as the Experimental Stations in Yurimaguas, El Porvenir, Moyobamba, Tingo Maria, San Roque, Puerto Maldonado, Pucallpa, Jaen and Pichanaki. The Program has identified more than 85 researchers, including 35 researchers who work in other National Programs and contribute to diverse components of the Program. In addition, more than 90 professionals who could work in extension and promotional work in the jungle have been identified. Research priorities are initially concentrated on aspects related to soil management, short cycle production systems, grasses, native crops, commercial crops (coffee and cacao) and agro-forestal systems. This National Program requires a high degree of intergration and inter-institutional cooperation. Therefore, coordinators have been named to work with the Special Jungle Development Projects, such as

those in Alto Mayo, Huallaga Central and Bajo Mayo, Alto Huallaga, Pichis Palcazu, Jaen- San Ignacio - Bagua, and Madre de Dios. Research and extension activities are also being coordinated with institutions such as the IRPA, VIHTR and regional universities.

3.3 National Support Programs

In order to contribute to the strengthening of NIARP's technical and administrative activities developed through its National and Regional Programs, its National Services and diversified Programs, between 1983 and 1985, two National Support Programs were created: the National Agroeconomic Program and the National Program for the Development of Human Resources for the NAIRP.

i) National Agroeconomic Program

In November, 1983, given the urgent necessity of integration socioeconomic aspects with all research and extension activities, the National Agroeconomic Program was created by the NAIRP. By identifying technologies that increase the efficient use of the resources of production units, productivity and farmer's incomes, the National Agroeconomic Plan works as a support mechanism for applied research and complements the extension service. To contribute to NAIRP's achievement of objectives, the NAP

provides agroeconomic information to producers and public institutions to assist in decision-making; it also provides direct support to the development of agricultural enterprises. This objective is achieved by means of a series of activities carried out by the Offices of Agroeconomy and Rural Commercialization of the NAIRP, in the central office and through the ARPCs. Information for producers basically refers to expected prices of products and raw materials, to the costs of production, yield and risk of different technologies, to production and investment plans at the level of production unit. This information is placed at the disposition of farmers through the extension system, and helps them to make decisions as to what to produce, with what technology and at what technological level, as well as to estimate the financial requirements and capacity for indebtedness. Information for public institutions is that which allows for policy decisions, based on a greater knowledge of the realities of agricultural production. This information is fundamentally oriented toward three institutions: the NAIRP itself, the Ministry of Agriculture and the Agrarian Bank of Peru. For the Bank, information on costs, yield and technological risks is important, as is information on the regional demands for credit and investment projects at the production unit level. For the Ministry of Agriculture, the information refers

to the needs for policies related to tariffs, prices and subsidies that, analyzed by the Agrarian Policy Analysis Group (APAG) and by the Sectorial Office for Agricultural Planning (SOAP), encourage agricultural production in the degree demanded by the national strategy for food production and the net balance of foreign currency. For the NAIRP, in addition to those aspects already mentioned, the information provided allows the Institute to adjust its Annual Plans, as well as to define research and extension activities according to economic and social criteria, especially to support other National Programs.

In order to achieve its objectives, the NAP has organized five major components, also called areas of action, which are the following: 1) Training and increase of the program's operational capacity, which is made up of five projects; 2) Information, which in turn, includes three projects: collection and management of agroeconomic data, analysis and dissemination of prices of products and materials, and analysis and diffusion of information related to costs, financial yield and risk; 3)Production systems and strenthening of enterprises; this includes two projects: identification and analysis of production systems to support the transfer of technology, and characteristics and development of systems of production and strengthening of enterprises; 4) Support for the Agricultural Credit

Program, which includes four projects: support for the Integral Assistance Programs (IAP); support for the credit programs through technical assistance; analysis of the factors which affects the demand for and use of credit; development of methods and practices for preparing small investment projects; 5) Agroeconomic research and agricultural policy, which included three projects: studies and promotional plans for production, by crops; evaluation of economic and social returns on investment in agricultural research and extension; analysis of the demand for basic products.

2) National Program for the Development of Human Resources

In 1984, the need to strengthen the capacity and increase the level of training of technical and administrative personnel at IAIRP became evident. Therefore, at the end of 1984 and the beginning of 1985, the Basic Document was written and at the beginning of March, 1985 the National Program for the Development of Human Resources for the IAIRP (NPHR) was created. As with the other Programs, the NPHR is directed by a Leader and a Co-Leader, but in addition, this Program has four other professionals; each one is assigned to one of the four areas into which the Program is divided. These areas are: 1)the area of institutional reinforcement, whose objectives are to contribute to the improvement of institutional

relations with national (especially the National Agrarian University) and international universities, with other national and international research and extension centers for training and development. This area also seeks to strengthen the educational capacity of the Preuvian universities and other educational institutions. 2) the area of personnel systems, which seeks to establish norms and procedures for the recruitment and selection of personnel, in order to reorganize activities and responsibilities of different jobs within the Institute. It organizes and manages an information system on the characteristics of the human resources of the institution, establishes the most adequate procedures and mechanisms for personnel management, establishes a system of information with respect to salaries, benefits and personnel registration, as well as establishing and managing human resource evaluation systems. 3) the area of training,which seeks to establish short-, medium- and long-term training programs, according to the areas of greatest need within the Institute; a follow-up system for training activities and a system for up-dating and specializing personnel at all levels, including post-graduate courses, continuing education, administrative training and technical-vocational training. 4) the area of studies of the situation, performance and productivity of human resourcesm as well as those resources used in their

training. The area will also carry out studies on the return on investments for the formation of human capital, evaluation studies of personnel and studies on socio-labor aspects and on salary and benefits policies.

3.4 National Support Services

In addition to the National Product Programs, the National Production Systems Programs and the National Support Programs, the INIAIRP has implemented and is implementing a group of National Support Services, which provide services to research and extension activities of the Institute itself, as well as to agricultural producers. The services provided include the following:

1) National Laboratory Service

The National Laboratory Service has been implemented in the research and promotional activities, To support research carried out by the Institute, the national service orients its activities toward solving problems of calibration of methods and determining critical levels of elements for different crops, in order to find a universal extract which

can be adapted to all soils and better orient fertilizing conditions for the farmer. The results are in the process of evaluation and are programmed to be carried to the national level. In relation to the promotional activities of the National Service, Soil Chemical Analysis Laboratories have been implemented, as follows: 1) In La Molina Experimental Station, for complete analyses; 2) in the Vista Florida, El Porvenir, Santa Ana and Andenes Experimental Stations and in the ARPC IV Huaraz, for routine analysis; 3) in the San Camilo Experimental Station and in the ARPC XV Puno just for modules. In the National Agrarian University, the National Laboratory Service has implemented a National Laboratory for training. In addition the Laboratory for Crop Protection at the La Molina Experimental Station has been re-equipped for entomyology, phytopathology, nematology and weeds; the Bromatological Laboratory at the same Station has been equipped with gas chromatography equipment.

2) National Service for Quantitative Methods and Analysis

The Basic Document for the National Service for Quantitative Methods and Analysis (SENAC) was approved in January, 1985. Presently, the Service has 25 micro-computers, including 14 IBM-PC, 9 Wang-PC and 2 Ohio Scientific-PC. There are plans for the acquisition of 1o more micro

(5 IBM and 5 Wang), and a medium-size computer, type VAX/730. There are also future plans for every ARPC to have two micro-computers of its own, one for all administrative activities and one for research, extension and agroeconomy.

With reference to research, SEMAC offers programs that include the control of research projects, and a data base for germoplasm, soils, water, etc. The project control system has applications to summarize research, evaluation and planning programs. The system has been especially designed to help in the annual planning of activities, review of objectives in each research area, evaluation of results and the presentation of projects correctly organized for the coming year. The project control system also has required the elaboration of manuals and the preparation and implementation of training programs. The available analysis systems include the following: SPSS-PC, MSTAT, RATS, MULBUD, PACT, PROCIN, D-BASE 2, LOTUS 1-2-3, MULTIPLAN, SUPERCALC.

With reference to extension, each project is described and catalogued by National Program, by source of financing, by beginning and termination dates, by the number of hectares that can potentially be attended by the

Extension Service, by productivity levels, by numer of participating farmers, etc. In addition, this system offers information about budget, expenses and data for the evaluation of each Extension Project. The Control System for Extension Projects is designed to assist the administration of the program, in budget control, in project evaluation and personnel evaluation.

The administrative activities of the Institute are also served by SEMAC. All its goods and services are catalogued, planning manuals have been prepared and inventory control systems have been established, as well as others for purchasing, storage, maintenance and security of all goods and services. In the area of personnel administration, a computerized system has been established which includes all personnel hired by the Institute. The employees are classified by their location, type of work, job title, position, salary range and assignment in the institutional structure, both for the main office and all ARDCs.

3) National Artificial Insemination Service

Also known as the National Semen Bank, the National Artificial Insemination Service is located near the National Agrarian University, in

La Molina. The National Service carries out training activities through courses in the techn logy of artificial insemination, which includes almost all the ARPC s in the nation. Likewise, the Service supports different production centers, principally peasant communities and some agricultural cooperatives, in the organization of their own artificial insemination services, advising them with respect to selection of adequate animals for genetic improvement projects through artificial insemination. The Nation Service carries out promotional activities by 1) progeny testing, in order to decrease the outflow of foreign currency to import frozen semen, when there is sufficient national semen available from genetically superior bulls; 2) production and distribution of frozen semen, at the rate of more than 20,000 applications annually; 3) obtention of studs, either by direct purchase/through agreements signed with the National Agrarian University and private enterprise; and 4) implementation of the National Artificial Insemination Service, which now has 17 units located in agricultural promotion areas and in extension agencies.

4) National Seed Service

During the second semester of 1984, the problem of seed production was analyzed in order to establish, through NAIRP, a national service to promote the multiplication, processing and use of improved seeds,

thereby contributing to a rapid increase in agricultural production due to increased productivity. During 1985, the National Seed Service (SENASE) organized all the information necessary to produce improved seed for the high-priority products identified by the National Product Programs. The process of organization included a system which allows the new varieties (with improved genetic potential, improved resistance to plagues and disease and improved adaptability to the agroecological conditions of each region) to have great impact on the production level. The Service will also ensure that the process of producing improved seeds, from the prebasic seed to the certified seed, not be interrupted by economic and/or logistic problems. SENASE has a rotating fund which allows it to buy and sell improved seeds with all the facility and flexibility the System requires.

5) National Agricultural Machinery Service

As was previously mentioned, the National Agricultural Machinery Service (SENAMA) was one of the institutions that was incorporated from the NIAR into the NIARP, at the moment of the latter's creation. SENAMA carries out its activities in the countryside, meeting the needs of small and medium-size farms, as well as the projects that seek to increase

agricultural acreage. SITAMA is made up of 8 regional agricultural machine services, 3 zonal agricultural machine services and 8 operation units.

4. MIARP Research Resources

4. Human Resources

The MIARP was formed with the personnel transferred from the National Institute for Agrarian Research (NIAR), the National Training and Research Center from the Agrarian Reform (CENCIRA), the National Agriculutral Machinery Service (SENAMA), the Ministry of Agriculture (especially from the General Directorate for Agriculture and Livestock) and from various technical cooperation projects. Some of these institutions were transferred to MIARP with their entire administrative structure intact. Therefore, the mixture of personnel transferred to the MIARP did not exactly correspond to the needs of the Institute, The Institute has also been severely restrained in its possibilities for personnel management by the Labor Stability Law. These two circumstances have made the management and development of MIARP's human resources somwhat difficult.

4.1.1 Development of Human Resources

The MIARP realizes that not all of its personnel have the education and talent necessary to carry out its work efficiently, and in response to

this situation, has created a Program for Development of Human Resources to improve competency at all levels. In-service training, short courses, intensive courses in the English language and formal training (graduate studies) are used when available and appropriate. Several indidivudals are presently abroad in graduate studies or practical training in the International Centers for Agricultural Research.

From October, 1983 to June, 1985, 52 NIARP employees have been studying in master's degree programs in the NAU, and ten have gone abroad (two to obtain master's degrees and eight to study for their doctorates). Approximately 870 NIARP technicians have participated in 40 short courses of one-week duration, while 416 other have participated in 16 two-day courses, on credit.

4.2 Physical Resources

Tables Nos. 1 and 2 have already illustrated the national and regional structure of the stations, sub-stations and experimental fields which make up NIARP's agricultural research structure. Table No. 4, estimated by Norton and Ganoza (1985), shows the evolution of NIARP's physical capital, in the form of stock in land, construction and equipment, from 1980 to 1984.

Table No. 3 - Distribution of NIARP Human Resources

	Central Office	SENAMA	ARRC	Total	%
		PERMANENT EMPLOYEES			
Executives	30	15	187	232	4.21
Professionals	204	23	1,058	1,285	23.29
Technicians	91	50	1,425	1,566	28.38
Assistants	180	181	2,073	2,434	44.21
Total Permanent Employees	505	269	4,743	5,517	100.00
		EMPLOYEES ON SPECIAL CONTRACT			
Professionals	42	12	196	250	40,26
Technicians	49	20	225	294	47.34
Assistants	36	25	16	77	12.40
Total Special Contract	127	57	437	621	100.00
		TOTAL			
Executives	30	15	187	232	3.78
Professional	246	35	1,254	1,535	25.01
Technicians	140	70	1,650	1,860	30.30
Assistants	216	206	2,089	2,511	40.91
GRAND TOTAL	632	326	5,180	6,138	100.00
Percentage	10.30	5.31	84.39	100.00	

Source: National Program for Development of Human Resources, NIARP.

Table No. 4:NIARP. Physical Capital, 1980 -1984

(in millions of current soles and in constant 1984 soles)

Year	Land[1]	Construction	Equipment[2]	Total	
	---- Millions of current soles			Total	Millions of 1984 soles
1980	94.3	821.1	8,425.1	9,340.5	119,572.1
1981	102.5	748.8	11,671.5	12,522.8	91,406.8
1982	153.5	1,520.3	16,579.3	18,253.1	81,017.1
1983	369.9	3,031.6	26,688.6	30,090.1	63,254.4
1984	553.7	8,001.0	53,726.7	62,281.4	62,281.4

1. Apparently, the value of the land has not been up-dated, and available information does not permit up-dating.

2. Includes office equipment.

Source: Norton and Ganoza (1985)

4.3 Financial Resources

Table No. 5, also developed by Norton and Ganoza (1985) incidates the growth of financial resources assigned by NIARP to its different agricultural resources programs from 1981 to 1985, and the proportion that the assigmations represent, with respect to the Institute's total expenses.

Table No. 5: NIARP, Costs of Agricultural Research and Total Expenses of Institution, 1981-1985

	Research Costs	Total Costs of Institution	Research costs/ Total Institute Costs	Research Costs
	Millions of current soles		%	Million of constant 1984 soles
1981[1]	4,455.1	8,667.5	51.4	32,522.3
1982	5,416.1	19,992.6	27.1	24,045.0
1983	10,970.8	52,430.5	20.1	22,152.0
1984	27,707.1	105,948.8	26.2	27,707.1
1985[2]	25,014.0	112,659.2	22.2	18,257.5

Source: Norton and Ganoza (1985)

1. The majority of research costs are part of the NIARP budget.

2. Budget to June, 1985. Does not include supplmentary credits obtained in July, 1985.

III. DESCRIPTION OF INSTITUTIONAL AND OPERATIONAL MECHANISMS EMPLOYED BY NIARP FOR EVALUATION OF AGRICULTURAL RESEARCH

A. Antecedents

Before beginning to describe the mechanisms and procedures used by NIARP in evaluation, it is necessary to briefly explain the structure of the Institute and its mechanisms for programming agricultural research.

1. Institutional Structure

The National Institute for Agricultural Research and Promotion, NIARP, is a decentralized public institution of the agrarian sector, with legal representation. It was created by Legislative Decree No. 21 (Article 26), January 19, 1961. Later, on March 27, 1981, Supreme Decree No. 046-81-AG determined the objectives and functions, the organization, functional relations, labor relations and economic resources for NIARP.

Article 5 of Supreme Decree 046-81-AG establishes the following functions for NIARP: "To program, direct, conduct, supervise and evaluate agricultural research activities, use of water and soil utilization"

On October 7, 1981, the Director's [illegible] Resolution No. 0113-81-NIARP, established the organic structure of NIARP's dependencies, including the centralized (main office) and decentralized portions (Agricultural Research and Promotion Centers - ARPC), according to the following scheme (See Figure No. 1):

DIRECTIVE ORGANIZATION

Director's Office

Director of NIARP

Assistant Director

Executive Director of Agricultural Research

Executive Director for Agricultural Promotion

Secretary General

Office of Public Relations and Information

CONTROL ORGANIZATION

Office for Internal Control

Director of Inspections

Director of Internal Auditing

ADVISORY ORGANIZATION

Office of Budget and Planning (OBP)

Director of Planning

Director of Technical Cooperation

FIGURE NO. 1 - STRUCTURAL ORGANIZATION OF NIARP

Director of Studies and Projects

SUPPORT ORGANIZATION

Administrative Office (AO)

Director of Personnel

Director of Budget

Director of Supplies

Director of Accounting and Treasury

Office of Technical Communication (OTC)

Director of Training

Director of Communications

Director of Documentation and Information Systems

ON-LINE ORGANIZATION

Director of Agricultural and Livestock Research (DALR)

Office of Biometrics and Information Systems

Director of Agricultural Research

Director of Livestock Research

Director of Agricultural and Livestock Promotion (DALP)

Office of Agroeconomy

Office of Agricultural Engineering

Director of Agricultural Extension

Director of Promotion of Rural Commercialization

National Agricultural Machinery Service (SENAMA)

Programming Office

Administrative Office

Director of Operations

Director of Maintenance

Director of Engineering

Director of Technical Asistance in Agricultural Mechanization

DECENTRALIZED ORGANIZATION

Agricultural Research and Promotion Centers (ARPC)

Director

Supervisor

Office for Internal Control (OIC)

Programming Office

Administrative Office

Personnel Unit

Accounting and Treasury Unit

Supply and Service Unit

Assistants

Documentary Administration Unit

Office for Technical Communication (OTC)

Office of Agroeconomy and Rural Commercialization (OARC)

Experimental Station

Director

Programming Unit

Administrative Unit

Biometric Unit

Library Unit

Crop Coordinator

Crop Protection Coordinator

Soil and Water Resources Coordinator

Testing Coordinator

Experimental Substation (ESS)

Agricultural Experimentation

Livestock Experimentation

Agricultural Promotion Zones (APZ)

- Director
- Programming Unit
- Administrative Unit
- Agroeconomuc and Rural Commercialization Unit
- Extension Coordinator
- Social Promotion Coordinator
- Crop Coordinator
- Livestock Coordinator
- Rural Commercialization Coordinator

Extension Agencies (EA)

- Sectors
- Sectors
- Sectors
- Sectors

Regional Agricultural Machinery Service (SEREMA)

- Zonal Agricultural Machinery Service
- Operations Unit

2. Research Programming System

Directive No. 004-83-NIARP-DIA, formulated by the Director of Agricultural and Livestock Research, established the norms for the formulation and approval of NIARP's agricultural research projects. (See Appendix No. 2). The objective of the Directive is:

"To establish norms for the content and procedures for the formulation, presentation and approval of research projects that are generated in the decentralized organizations of NIARP."

The Manual for the Formulation of Agricultural Research Projects (On-line projects and sub-projects , approved by Directive No. 004-83-NIARP-DIA established the following figures for agricultural research;

2.1 Research Projects

Agricultural research will be developed in two stages: basic and complementary.

a) Basic Research - oriented toward the increase of scientific knowledge, through the search for new principles and comprehension of basic processes. It is generally developed based on the focus of inherent problems in one or more scientific disciplines. This type of research is not necessarily directed toward the productive process.

b) Applied Research - directed toward the process of production and oriented toward the adoption of new principles and techniques linked to scientific problems. Its development is based on the problems inherent in each crop or species, first of all, and, secondly, on the development of socio-economic systems.

An agricultural research plan should, in general terms, include PROGRAMS focused on:

-Crops or livestock: applied research for poly-crops or livestock species (Potato Program, Corn Program, Livestock Program, etc.)

-Production Systems: research on crops, agrosystems, production units or production regions.

-Systems for the protection of the ecosystem (Soil Program, Integrated Plague Control, etc.)

-Socio-economic situation of the farmer, etc.

A research problem is developed by defining and prioritizing generic problems, which in done in participation with specialists in research and promotion and representatives of the agricultural sector. A review of the technology available in relation to each generic problem will indicate

whether the solution of the problem is through action in research or promotion, according to the availability or lack of technology.

2.2 Line Projects

Research on a generic problem inherent in a Program is called a Line Project. For example, in a Wheat Program, one of the priority problems would be reflected in a Line Project entitled "Control of Wheat Rust in La Libertad Highlands". This Line Project, like many other, will require the use of one or many scientific disciplines such as genetics, vegetable physiology, entomyology, phtyopathology, edaphology, etc., in order to solve the problem of wheat rust. A Line Project will be regional in character if the problem is located in a specific area, but it could also be national, if the incidence of the problem were wider.

2.3 Sub-Projects

Many Line Projects, in turn, are carried out through much more defined action, called Sub-projects, which are each of the experiments, surveys, specific activities, etc., that are necessary - either simultaneously or in series - in order to reach the objectives of the Line Project. A Sub-project can include various experiments, surveys, etc,, repeated in different places or at different times, if they are carried out with

the same methodology.

2.4 The National Plan for Agricultural Research

The National Plan for Agricultural Research (Apprendix No. 3)* is not considered as yet another program, but as an administrative instrument for the diffusion of the Institute's activities.

The National Plan is made up of Programs, Line Projects and Sub-projects.

2.5 Operative Mechanism for the Formulation and Approval of Projects

The Director's Office established the following operative mechanism for the formulation and approval of Line Projects and Sub-projects:

2.5.1 The Line Projects and Sub-projects will be presented in original and three copies, such that, once approved, they be distributed as follows:

Original- Executive Director of Agricultural and Livestock Research

1 copy- Director of the Experimental Station

1 copy - Leader of the National Program

1 copy- Appropriate Research Unit.

2.5.2 Regional or national Line Projects will be formulated by a qualified

* Apprendix 3 contains only the National Rice Program, as an example of the National Plan for Agricultural Research

specialist, to be revised by his Director and/or National Leader, as the case may be. A specialist in statistics will also participate and advise, as will other specialists, depending on the disciplines included in the Project.

2.5.3 Once the Line Project is formulated, it will be taken to the Technical Committee named by the Directors of NIARP, for review and approval. If there are questions, suggestions for improvement, etc., it will be returned.

2.5.4 The formulation of the Sub-project will be the responsibility of the researcher, who will be supervised by his National Leader and advised by a specialist in statistics and by all those related to the disciplines included in the Project.

2.5.5 It is recommended that, insofar as possible, a specialist in Agrarian Economy participate in the Line Projects and Sub-projects.

2.5.6 The Sub-project will be approved by the Director of the Experimental Station and then sent to the appropriate ARPC Director, who will authorize it.

2.5.7 The Line Project formulated for budgeting in a given fiscal year should be presented the year before, according to the followin deadlines:

MONTH	WEEK	
April	1,2,3	Forumlation of the Line Project Review and Approval by Technical Committee
	4	Approval and authorization by the Executive Director of Agricultural and Livestock Research

2.5.8 Once the implementation of Line Projects is authorized, the corres-

Sub-projects will be formulated and presented for approval no less than one month prior to the date given for their initiation.

It was also established that for Sub-projects that continue for periods longer than one year, it is only necessary to present the Working Plan and its corresponding Annual Budget. The Director's Office also defined its range of application to all Decentralized Organizations in NIARP, as well as to those institutions that celebrate contracts or agreements for carrying out agriculutural research projects with NIARP. The Office of Biometrics and Information Systems of the Office of the Director of Agriculutral and Livestock Research was given the responsibility of organizing a file of all information related to research projects on a national level, in order to integrated and consolidate the National Plan for Agricultural Research. Finally, the Biometrics Unit of each Experimental Station was made responsible for organizing a similar file for all research projects for which it has direct responsibility.

2.6 Later Modifications to the Programming System

Beginning in 1984, some fundamental changes were made in the definitions and operative mechanism of the programming of agricultural research.

2.6.1 The terms "Line Project" and "Sub-project" disappear, and are replaced by "Research Line" and "Research Project", respectively.

2.6.2 In the forms for "Research Projects" (formerly Sub-project), there appear spaces for:

a) Identifying the problem that the Research Project is expected to solve.

b) Formulating the hypothesis (es), indicating the points of view that theory presently describes, with respect to the problem to be solved.

The scientific hypothesis is a proposition made by the researcher as to the possible causes or variables that determine a problem. When the problem is well-identified and correctly described, it will always be possible to formualte a hypothesis as to the causal variable, its relations and interrelations. A hypothesis formulated in this manner will always be implicitly or explicitly linked to scientific theory, which is known to and understood by the researcher. Basically, the scientific hypothesis should include: 1) the theory or scientific basis; 2) the prediction; and 3) the manner in which the prediction will be verified.

B. Establishment, Objectives and Characteristics of Supervision and Evaluation Mechanisms and Procedures

1. Establishment

Directive No. 03-83- NIARP-DE - DIA formulated by the Director of Agricultural and Livestock Research, established the norms for supervision and evaluation of agricultural research at NIARP (See Appendix No. 4).

2. Objectives and Goals

The objectives of the norms of supervisin and evaluation are:

-To establish an institutional framework in order to norm supervisory and evaluational activities in agricultural research.

- To establish the baisc norms used to control and evaluated the execution of agricultural research activity on a national level.

The principal goal of the Directive was to norm the procedure for supervision and technical evaluation of the National Plan (Programs, Line Projects and Sub-projects) that are carried out by the Decentalized Organizations of the NIARP, as well as those carried out by other research organizations by means of contracts or agreements with the NIARP.

3. Scope of Supervision, Periodicity and Elements of Judgement

It is indicated that supervisory and evaluational activities will be carried out on both national and local levels periodically ("... at least two annual visits per Experimental Station") or, by disposition of the Director's Office, whenever judged convenient. The following elements of judgement will be taken into account in supervision and evaluation:

- Development Plan for the Agricultural Sector
- Diagnosis of Agricultural Production
- National Plan for Agricultural Research
- Line Project and Sub-project (later defined as Research Line and Research Project, respectively)
- Available resources
- Periodic reports
- Publications

4. Procedures and Operative Mechanism for Supervision and Evaluation

4.1 Preparation of the Supervision Plan

The Supervision Plan in the ARPC Experimental Stations and other institutions where research is being carried out under contract or agreement, will receive final approval by the Executive Director for Agricultural and Livestock Research, and will be communicated to the Executive Office.

Supervision implies at least two yearly visits to each Experimental Station.

4.2 Dependencies to be Supervised

The dependencies to be supervised include all the ARPC Experimental Stations, as indicated in the Appendix "Research Dependencies to be Supervised", as well as those institutions carrying out research under contract or agreement (See Appendix No. 4).

4.3 Operative Mechanism

There should be a sequence of interviews, as indicated below:

4.3.1 With the Director of the ARPC

This is especially important when his location coincides with the Experimental Station(s) to be supervised. Alternately, other methods will be used to supervise when the Director is located elsewhere.

4.3.2 With the Director of the Experimental Station

The necessary documentation will be requested, for better execution of the activities to be carried out, and the activity plan will be made. The implementation of prior recommendations made in supervisory visits

will be verified.

Forms 01,02, 03, 04,05 and 06 DE- DIA (See Appendix No. 4) will be given out, in order to up-date human, physical and budgetary resource information.

4.3.3 With the Director of the Experimental Station and the Researchers The objectives and the supervisory plan will be presented. Those being interview must bring the necessary documentation (Programming of Line Projects, Sub-projects, periodic reports and publications) and any additional information to be used during the individual interviews.

4.3.4 Individual Interviews with Researchers

In these individual interviews, the execution of the experiments for which the person is responsible will be analyzed, including the necessary documentation for review and verification.

The goals for the year will be contrasted with what was actually achieved by the date of the supervisory visit. Forms Nos. 07-DE- DIA and 09-DE-DIA will be used for the national and local levels (See Appendix No. 4).

In the review of Line Projects or Sub-projects, the study objectives will be verified for clarity and the study's approval will be verified.

In field visits, or visits to greenhouses or laboratories, the work underway will be verified. The plan, suggestions to be made and problems which have appeared will be discussed. One of the important aspects of supervision is the grading of fieldwork, which will be evaluated as EFFICIENT, SATISFACTORY or DEFICIENT.

EFFICIENT: When the conditions in which the experiments or activities are such that they guarantee that the information required will be provided by the results.

SATISFACTORY: When the conditions seem to indicate that the information provided will be technically or socio-economically valid.

DEFICIENT: When the conditions found offer no guarantee that the information sought will be obtained.

The reports on finished experiments will be reviewed; they should include information of experimental results obtained during the year. The person who carried out the experiment or activity will fill out form No. 09-DE-DIA and, to summarize the reort, he will use for No. 10-DE-DIA (See Appendix No. 4).

To review finished Sub-projects, the last finished experiment will be reviewed , based on the information in form No. 09-DE-DIA. This refers to the consolidation of all of the experiments or other programmed activities, according to the nature of the study. The form of the report prepared by the researchers must include the following items:

-Title

-Author

-Introduction

-Review of Literature

-Materials and Methods

-Results

-Discussion

-Conclusions

-Recommendations

The report will be made by the Director of the Experimental Station to the PIARP Director, with a copy sent to the Executive Director of Agricultural and Livestock Research, for its dissemination.

Other activities related to agricultural research include basic seed, seedlings, animals (studs), publications, consultations, analyses, diagnosis (crop and/or livestock raising protection), etc. (See Forms Nos. 11, 12, 13, 14, 15, 16-DE-DIA, Appendix No. 4).

4.3.5 Final Meeting

The final meeting will take place with the researchers of the supervised unit. The supervisor will make general comments on the work underway, mentioning all the suggestions and recommendations included in the report. The most important ones will be given in written form to the Director of the unit supervised, for their immediate implantation or execution. Copies of the recommendations will be sent to the Executive Director of Agricultural and Livestock Research and to the appropriate ARPC Director.

5. Final Evaluation

The information obtained in the supervisory vistit will be used to make the final yearly evaluation of each ARPC, according to the following guidelines (See also: Form No. 17-DE-DIA, Appendix No. 4).

5.1 Framework of the Agricultural Research System

Mention of the general functions met by the Experimental Station(s) with respect to the regions they serve, indicating ARPC Production Zones.

5.1.1 Structure of the Agricultural Research Program, Experimental Stations included in the ARPC organization and the Production Zones covered by each one.

Criteria for evaluation:

-Human potential

-Total number of workers: percentage of professional, technical personnel and assistants

-Training level of professional personnel: percentages by specialization or academic degrees.

-Physical resources

-Construction, equipment, land for research: indicate if adequate, sufficient, insufficient or lacking

-Budgetary resources

With respect to the function that each has, indicate if sufficient or insufficient.

5.1.2 Principal Technological Problems of Crops, Livestock and/or Disciplines, in general or in Experimental Stations.

Indicate the problems mentioned in the Development Plan for the Sector and the one considered to be most outstanding.

5.2 Development of the Agricultural Research Plan

The plan will be evaluated according to the following criteria:

5.2.1 Operation program goals planned and met in the Experimental Stations and through contracts and agreements (Quantitative evaluation)

5.2.2 Research Project

The achievement of research line goals will be evaluated in relation to priorities.

5.2.3 Production of seed, seedlings and livestock

The achievement of goals and the contribution of basic seed for the

establishment of public or semi-public greenhouses will be anaylzed. In the case of animals (studs), the contribution to users will be considered

5.2.4 Dissemination of research results

The achievement of goals and rendering of serviced with respect to publications, consulting activities and seminars will be analyzed.

5.3 Conclusions

The conclusions reached in the evaluation process will be indicated.

5.4 Recommendations

Appropriate adjustments will be proposed, such that the research is congruent with the National Plan for Agricultural Research.

6. Later Modifications

In July, 1985, in order to facilitate the activities of supervision and evaluation, the System of Follow-up Information was put into effect for experiments carried out under the National Plan for Agricultural Research. The goal was to be able to have rapid and up-dated information (programmed for computer analysis) with respect to the progress of experiments and the problems affecting them.

The System of Follow-up Information for experiments represents another step in the process of perfection and rapidity in the collection and analysis of information that was previously collected through Forms Nos.

07,08,09 and 10-DE-DIA, as mandated by the norms for supervision and evaluation approved in 1983 (Appendix No. 4).

The System for Follow-up Information requires that form OBI.85.06 (Appendix No. 5) be filled out, based on information provided by the researcher responsible for the experiment, according to the coding table provided (Appendix No. 6).

7. Institutional Location

Evaluation activities of agricultural research (in the widest sense, including follow-up, supervision and control, as well as the evaluation per se.) are carried out by several branches of the Institute.

7.1 At the National Level

Follow-up of experiments underway in each research project is coordinated by the Director of Agricultural and Livestock Research, with the support of the Office of Biometrics and Information Systems.

Periodic control and verification activities with respect to the observance of norms and procedures for use of physical, financial and human resources, according to the General Control Law, are done by the Office for Internal Control (OIC).

Specific follow-up studies and other related evaluation activities are carried out by the Follow-up and Evaluation Unit, created by loan

agreement NO. PE2150, made by the World Bank to the Peruvian Government, approved in 1982, to be used by the NIARP. The Unit, which has especially hired personnel, is functionally and adminsitratively linked to the Office of Budget and Planning (OBP), NIARP.

Socio-economic evaluation activities of agricultural research are carried out by the National Agroeconomic Program (NAP), which was created in November, 1983; these activities support the functions of the Office of Agroeconomy and Rural Commercialization (OARC), created in 1984. The areas of action in the NAP which are related to a) systems for the production and strengthening of enterprise; b) support for agricultural credit programs; and c) agroeconomic research; develop and execute projects and studies of the socio-economic value of agricultural research. Further information of the projects and studies will be given later on.

7.2 In Decentralized Organizations

Evaluation activities of agricultural research carried out by different areas and programs at the national level have their counterparts in the decentralized organizations - the ARPCs - of the Institute.

The Experimental Stations and Sub-stations carry out the activities of supervision, follow-up and evaluation, according to the directives and norms given by the central office (Executive Director of Agriculture and Livestock Research, Office of Budget and Planning, etc.) and the res-

pective ARPC.

The Programming Offices in the ARPCs - I(Piura), II (Chiclayo), III (Trujillo), IV (Huaraz) and IX (Cajamarca)- which cover the area partly financed by the World Bank project, support the activities of the Office of Follow-up and Evaluation of the OBP.

The Internal Control Offices of the ARPCs support the periodic control and verification activities of the CIC at the national level.

The ARPC Offices of Agroeconomy and Rural Commercialization support the activities and carry out part of the Annual Plan of the National Agroeconomic Program and the OARC at the national level.

8. Role of the International Institutions

The participation of international institutions for technical and financial assistance (these last ones through loans and donations) in the definition of objectives, programming, execution, follow-up and evaluation of agricultural research in the NIARP can be summarized as follows:

8.1 World Bank

The Loan Project No. PE2150 made to NIARP by the World Bank (for a net amount of 40.6 million dollars, plus a national contribution of 39.4 million dollars) prior to the creation of the Follow-up and Evaluation

Unit, which, according to the organizational scheme of the NIARP, reports to the Office of Budget and Planning. Of the total cost of the Prjoct, 650,000 dollars were set aside to finance the Unit for five years - 178,000 dollars for the first year and 118,000 for each of the remaining four. These resources are for the purchase of vehicles and office equipment, and to hire six professionals, ten mid-level technicians and three assistants.

The World Bank Project specified that research would be supervised by the research coordinators of the product progr ms, and by the head scientists at the Experimental Stationa, with the assistance of the Co-Leaders of the National Programs. The research program would be subject to annual review. In addition to follow-up and analysis, this would permit the quality of research to be examined. In addition the studies made by the Unit could serve as the basis for the assignation of human and financial resources among alternate programs. Each research project would be graded (ex-ante evaluation) according to the degree of achievement of its specific objectives, its relation to existing problems, the urgency of the problem, the goals of the National Programs, costs in relation to potential benefits and the probability of obtaining similar research results in some other place.

In addition to the internal review mentioned, the World Bank Project specified that research programs would be reviewed every two years by an external group of chosen specialists, The group will also begin an

initial study of the organization of the NIARP in the areas of research and extension,and would give the necessary assistance with respect to the implantation of an internal system by the Institute itself.

8.2 A.I.D.

The Research, Education and Extension Project (REE), approved in February, 1980, was financed by A,I.D. through a loan to the Peruvian government for 9 million dollars, a donation for technical assistance for 2 million dollars and a contribution by the Peruvian government for 4 million dollars,after establishing an evaluation plan at three levels:

a) At the attaché level, to evaluate:

-changes in production resulting from increased yield and increased area under cultivation;

-changes in imports and exports;

-changes in the real prices of products resulting from changes in supply;

-changes in the level of spending by the government with respect to the support required; and

-requests for evaluation of the project's progress in relation to its structure and its program.

b) At the level of the REE program itself, to evaluate:

-number and quality of personnel trained by the project;

-quality of operativity of the National Product Programs, over a period of time;

-quality of adaptive research, reflected in production changes; and

-costs.

c) At the level of selected components of the REE Project, to evaluate:

-National Product Programs;

-Regional service laboratories;

-various levels of the training program.

In every case, the evaluation would be comparative, discussing planning and what was actually implemented. For example, in a National Product Program carrying out its activities in rural areas, the evaluation would consist in measuring the difference between what was planned and what was implemented, in the following manner;

-quantity and quality of program technicians;

-dissemination and use of technological packets;

-requests for technical assistance; and

-rates of adoption of technologym changes in production, etc.

The evaluations mentioned would be made yearly by the AID mission in Peru and the NIARP (at the time, in 1980, it was the National Institute for Agrarian Research, NIAR), through its REE Project Administration division, beginning one year after the implementation of the Project. Finally, the Project considered that short-term technical assistance would be necessary to assist the Institute in the development of a con - ceptual model and in the selection of specific evaluation models.

In practice, the Evaluation Plan for the REE Project has been carried

out with the participation of diverse instiutions, areas and programs. In the Plan, which included internal and external evaluation activities, the AID mission in Peru, North Carolina State University, INIAP, through its Office of Agroeconomy and Rural Commercialization and its National Agroeconomy Program, the World Bank and the Interamerican Development Bank have all participated; the last two entities supplied professionals which were requested in different evaluation missions.

In this section, it is important to recognize and point out the fundamental role that North Carolina State University (NCSU) has had in all the internal and external evaluation activities of agricultural research in INIAP, as well as in the Institute in general. With respect to internal evaluation, NCSU had a very significant role in the elaboration and implementation of the National Agroeconomic Plan (NAP). Essentially, NAP is a program designed to permanently evaluate the activities of technology generation and transfer, to verify its adoption and the factors favoring or disfavoring said adoption. Thirteen of seventeen NAP projects (See Appendix No. 7) are directly or indirectly designed to evaluate agricultural research activities, to identify and resolve problems that make the adoption of technology more difficult, and to evaluate the present and potential impact of new technologies. In the section relating to the description and evaluation of evaluation methodologies used by the INIAP, the experiences and results of the NAP will be presented and discussed.

The activities and results of external evaluations promoted and developed

by international institutions will be presented in Section IV.

8.3 I.D.B. and I.I.A.C

Both the Interamerican Development Bank and the Interamerican Institute for Agricultural Cooperation have contributed to the evaluation of agricultural research carried out by the PIARP, as well as to the evalutaion of the Institute as a whole. The contribution was channelized through the Special Program for the Agricultural Sector Project (SPASP), which made it possible for the I.I.A.C to hire a group of trained professionals who took charge of some of the projects implemented by the PIAP.

8.4 JUNAC

The Cartagena Agreement Board, JUNAC, also collaborated in the process of evaluation of agricultural research, by financing for PIARP two pilot projects in its Support Program for Rural Technological Development (SPRTD). The first project was designed to meadure the rate of adoption of new technology by small farmers in the highlands of the Department of La Libertad. The second was designed to develop a methodology to make a technological inventory, both at the national level and at the level of the Andean Group nations.

IV. OTHER INSTITUTIONAL EVALUATION EXPERIENCES

There is not much eveidence of other institutional evaluation experiences of agricultural research in Peru. Evidently, as will be shown in Sections V and Vi, the largest institutional evaluation experience in Peru was undertaken by the National Institute for Agricultural Research and Promotion. The only evidence found in available literature with respect to an ex-post evaluation of a research program is the Hines study, done in Peru with the logistic support of the National Agrarian University, as a doctoral thesis for Princeton University in 1972. The study, entitled "The Utilization of Research for Development: Two Case Studies in Rural Modernization and Agriculture in Peru", evaluated the economic and social returns on investments made in corn research in Peru between 1954 and 1967. The study utilized the cost and benefit data of the research projects referred to and followed the method known as economic surplus (more information will be given on this method in Section VI), to estimate the benefits derived from a skewing to the right in the corn supply curve, thereby estimating the benefits of a surplus for consumers and producers. The principal results of the study were the following: 1) the internal rate of return on investments in corn research in Peru in the period from 1954 to 1967 varied from 35% to 40%; 2) when, in addition to the benefits of corn research, the benefits of the recommendations of a complete "technological packet" for corn were considered, the respective rate of internal return varied from 50% to 55%.

V. CHARACTERIZATION OF THE INIARP EXPERIENCE IN EVALUATION OF AGRICULTURAL RESEARCH

1. Internal Evaluations

As was mentioned in Section III, evaluation activities in agricultural research in INIARP, including follow-up, supervision and control activities, as well as the evaluation per se, are carried out by different sections of the Institute.

The follow-up of experiments, including identification of problems that affect the execution phase, in order to take corrective measures, is coordinated by the Director of Agricultural and Livestock Research, with the support of the Office of Biometrics and Information Systems, and more recently, with the support of the National Service of Quant tative Methods and Analysis. In addtion, at the national level, superision control and periodic verification activities are undertaken by the Office of Internal Control, to ensure that the diverse sections of the Institute are meeting the norms and procedures established for the use of physical, financial and human resources, and by the Manual of Functions, according to the General Control Law. Some specific studies and other evaluation activities are carried out by the Follow-up and Evaluation Unit, which was created by the PE-2150 Loan Agreement between the World Bank and the Peruvian Government. In 1982, it was approved and given to the INIARP for execution. The Follow-up and Evaluation Unit, which uses specially

hired personnel, is functionally and administratively tied to the Office of Budget and Planning (NIARP), and to date has undertaken various studies, as will be seen farther on. Socio-economic evaluation activities of agricultural research are carried out by the National Agroeconomy Program, as a support function to the Office of Agroeconomics and Rural Commercialization. To date, the Program and the Office have made several evaluationa studies and projects, principally in the areas of production systems and strengthening of enterprises, support for agricultural credit programs and agroeconomic research, through which it carries out projects and studies for socio-economic evaluation of agricultural research. The Program, using professionals from North Carolina State University and Virginia Polytechnic Institute and State University , through a contract with A.I.D. in Peru, made a cost/benefit study of agricultural research and extension in Peru in 1985. The study will be discussed in greater detail later.

With respect to the decentralized part of the Institute, evaluation of agricultural research takes place in diverse areas of the Agricultural Research and Promotion Centers. The Experimental Stations and Sub-stations carry out supervisory, follow-up and evaluation activities according to the norms and directives from the central office, through the Executive Director of Agricultural and Livestock Research, the Office of Budget and Planning, and the NIARP itself. The Programming Offices in the ARPCs in the northern part of the country (ARPC I- Piura, ARPC II - Chiclayo, ARPC III- Trujillo, ARPC IV- Huaraz and ARPC IX-

Cajamarca), which cover the area partially financed by the World Bank Project, support the activities of the Follow-up and Evaluation Units. The Office for Internal Control in the ARPCs support the supervision, control and periodic verification activities of the CIC at the national level. The Offices for Agroeconomy and Rural Commercialization in the ARPCs support the activities and carry out part of the Annual Plan of the National Agroeconomic Program, as well as the national Office for Agroeconomy and Rural Commercialization.

In addition, the NIARP Annual Report which refers to 1984, entitled "Actions and Achievements of the National Institute for Agricultural Research and Promotion", published in 1985, is essentially an internal evaluation exercise, as are the extension and agricultural promotion activities developed by the Institute. As will be seen later, the Report presents an evaluation of the impact of the Institute's activities, in terms of average yields obtained by farmers, for the principal agricultural products of the country from 1980 to 1984. To make the Report, different areas of the central office, all of the ARPCs and investment Projects, North Carolina State University, the Israeli Association for International Cooperation, the technicians assigned to the National Product Programs , the National Production Systems Programs, the National Services, the National Support Programs, and the Cooperative Support Programs for Agricultural Research (Tropical Soils and Lesser Ruminants) all participated.

2. External Evaluations

In the 1984-1985 period, at least four large external evaluations took place. These evaluations were not limited to agricultural research activities, but also included extension, training and agricultural promotion activities. The first two external evaluations had already been planned and programmed by the Investment Projects themselves; the third was especially requested by the Director of the Institute and the fourth took place as a consequence of the conclusions and recommendations of the first.

The evaluations were 1) Evaluation of the Project for Agricultural Research, Education and Extension (REE Project), which is the result of a loan agreement and donation signed between the Peruvian Government and the A.I.D. in 1980. 2) Evaluation and Supervision of the Project for Agricultural Research and Extension (ARE Project), which is the result of an agreement signed between the World Bank and the Peruvian Government in 1982. 3) Evaluation of the institutional model of the INIAP, by the International Service for National Agricultural Research (ISNAR) mission. 4) Evaluation of the feasibility and effectiveness of the Peruvian system for agricultural research, education and extension, which was promoted by the A.I.D. and the INIAP.

In Section VI, the objectives, methodology and principal conclusions and recommendations resulting from each of the external evaluations mentioned.

3. Evaluation Periods

From among the most characteristic types of permanent and eventual evaluation of agricultural research, the NIARP has selected follow-up activities (monitoring) and ex-post evaluation of agricultural research. In the yearly meetings to review the programming and projects that make up the National Programs and to develop new projects for those Programs for the following year, the concept of ex-ante evaluation of agricultural research has been introduced. Some specific attempts have been made to carry out this type of evaluation. However, to date a systematic ex-ante evaluation study has not yet been made, nor is there any available publication of such a study in this area. The follow-up activities on the research projects are made by different areas of the Institute, according to the methods already mentioned and described. The follow-up activities for the National Programs are acrried out as follows: 1) Through the Annual and Quarterly Reports presented by the Co-Leaders of the Programs. 2) Through periodic visitsmade at different levels by Institute executives, as well as by executives and directors of the Investment Projects, Universities and International Centers for Agricultural Research. The visits are made to the main offices of the National Programs and to their respective sattelite offices, often including visits to the farmers directly or indirectly affected by the National Programs, as well. 3) By means of specially designed studies made at irregular intervals by diverse areas of the Institute, but especially by the National Agroeconomic Program, through the Office of Agroeconomy and Rural Commercialization and by the Follow-up and Evaluation Unit of

the World Bank Project. In both cases, the central offices are supported in their efforts by the decentralized structures in the ARPCs.

4. Elements and Level of Evaluation.

Follow-up and evaluation activities at NIARP take on many forms, without having reached any sort of systematization. Through follow-up activities on the research projects, the technical results are evaluated, and the same objective is reached by the evaluations of the National Programs. By means of specific follow-up studies and accompaniment of farmers directly or indirectly affected by research and extension activites, the degree of dissemination of technology is evaluated, as are the results of research projects. In reference to the real impact of the use of generated technologies, also known as impact evaluations, there have been some evaluative studies of yield (rates of return), through the analysis of costs and benefits of research and agricultural extension developed by NIARP. Follow-up and evaluation of research is done at the project level and also for the National Programs, principally through internal evaluations, and at the institutional level, through external evaluations. Likewise, evaluation activities include the micro-economi level of studies carried out at the production unit level and the macro-economic level, by means of the expansion of the mirco-economic results and the observation and analysis of statistical reports produced by the NIARP and by other institutions in the agricultural sector, such as the Sectorial Office for Statistics and the Sectorial Office for Agrarian Planning

and by other official statistics institution in other sectors of the economy.

VI. DESCRIPTION AND ANALYSIS OF PRINCIPAL INTERNAL AND EXTERNAL RESEARCH EVALUATION STUDIES DEVELOPED BY (AND FOR) PIARP

This section presents a group of evaluation studies made directly by the PIARP, or at its request. Each study will be described and related to the different topic presented in Section V.

A. Internal Evaluation

1. Follow-up Studies

Since the follow-up or monitoring strategy, organization and methodology applied to agricultural research projects and discussed in Section III was so recently implanted (July, 1985), there has not been sufficient time to present its most important results on the national level. There has been even less time to evaluate the follow-up system. It is hoped that during 1986 the first concrete results of the follow-up system for projects and experiments, established in 1985, will appear. However, given the characteristics of the system, its facilities for programming and computation already included and its characteristics with respect to 1) facilities for tabulation of information collected (by experiment, project, program, location, province, department, ARPC, National Program, natural region and national totals) and 2) linkage to a coding system for follow-up on any experiment or project, it is hoped that the overall system have great versatility, agility and effectiveness,

such that the Institute directors and other authorities can immediately take the corrective measures required by any project or experiment.

The Follow-up and Evaluation Unit of the World Bank Project for Agricultural Research and Extension already has a follow-up methodology for extension services, which has been tested in the ARPCs in I- Piura, II- Chiclayo and IX- Cajamarca. In its manual for follow-up and evaluation of agricultural and rural development projects, the World Bank establishes as policy that the follow-up system should be considered as part of the general administration, since follow-up and evaluation "should be at the service of management and closely identified with it." Although this refers to specific follow-up activities for extension, the manner in which they affect the production systems and the productivity of the farmers directly or indirectly attended by the extension service and whether the impact on production systems and productivity would have been possible without the assistance of agricultural research and its results produced within the Institute or adpated by it, it is still important to summarize and discuss the characteristics of two studies made by the Follow-up and Evaluation Unit.

1.1 Follow-up on Participating Farmers at the ARPC I-Piura

The principal objective of the study was to follow up on some indicators of efficiency and effectivity of the extension system used at ARPC I-Piura, determining the frequency and duration of the visits of personnel attending the sector, the level of adopting of the messages, the type of message most frequently adopted, the message irradiation

level and the opinions of participating farmers with respect to the extension service. Since the study methodology determined a sample of 77 farmers among those existing in ARPC I, the sample was made in three stages by chance. In the first stage, of 18 agencies, 9 were chosen randomly. In the second stage, and also at random, 36 of a total of 39 sectors were chosen and in the third stage 2 participating farmers were chosen, on the average, for each sector. With the farmers selected, a survey was taken by two field teams which, appropriately supervised, worked according to the geographic distribution of the agencies, After coding the information received in the interviews and having refined the information, the SPSS-x program was applied.

The principal conclusions of the study were as follows: 1) The average estimated age of the farmers participating was 45, an age considered adequate for the reception of knowledge and its application to obtain increased production yield. The level of education is acceptable; 41% of those interviewed had completed elementary school and 20% had studied at the secondary level. 2) The participating farmers at ARPC I generally have large families between 6 and 10 dependents, but the level of participation in farm work by family members is generally limited to 1 or 2). 3)The average size holding is five hectares, which might indicate that the selection of participating farmers has been based on th se who offer a minimum protential for application of knowledge transmitted. 4) The most important products-rice, corn, lemon and banana. 5) 88% of the farmers are visited by the sector employees and 61% receive visits once every two weeks. On the average, they have been visited

by the extension service for twenty months. The average duration of a visit is one hour and ten minutes. 6) 91% of the farmers are in agreement with the messages transmitted by the extension service, which shows that the degree of acceptance is relatively good. The messages most widely disseminated are those about planting, fertilization and phtyosanitary treatment. 52% of the participating farmers consider that the messages are useful because they help to produce more. The average level of reception was calcuated at 91%, while the average level of comprehension was calculated at 89%. 7) 71% of the participating farmers had solicited credit, but only 22% received the total sum requested opportunely; 19% received partial but opportune credit and 19% received the full amount requested but ot when requested. 8) With reference to commercialization, it was verified that the participating farmers' production is sold as frequently in the production unit as in the local markets. 9) The degree of irradiation is 5 farmers for one participant in the program. 10) As a general comment, it can be concluded that the participating farmers ask for more talks and demonstrations, a greater frequency of visits and support in their paperwork with the Agrarian Bank for rapid credit.

1.2 Follow-up on extension activities and an evaluative test in ARPC IX - Cajamarca, Agricultural Campaign, 1984-1985

The main objective of the study was to measure the degree in which extension activities are being carried out in ARPC IX - Cajamarca, and the manner in which participating farmers have been responding to the activities. In addition, the study attempted to test an indirect measurement of the effects or

impact of the Agricultural Research and Extension Project (ARE Project) financed by the World Bank. With respect to methodology, the study got its basic information from a survey applied to a sample of participating farmers. The sample design was stratified at two levels, also known as double stratification, in which the first level of stratification considered the extension agencies in the ARPC and the second level considered the sectors within the agencies. In each sector, a random sample was taken of five participating farmers. Both the design and the sample size were defined by a previous study which was oriented to adjusting the sampling errors of the main indicators and variables to no more than 10%. The sample size was 190, of a population of 1,085 farmerswith which the ARPC IX-Cajamarca has been working. The basic follow-up indicators used were visits, messages and the opinion of the farmers about the extension service. With respect to the visits, the variables measured try to evaluate their effectivness in terms of 1) their frequency, according to the training and visits theory used (visits always occur on a fixed day of the week), and 2) their quality, related to the duration of the visit, the number of neighboring farmers present during the visit and the proportion of visits in which the agricultural or livestock training units are used. As a complement to the visits, group extension activities (Field days, demonstration fields, etc.) were studied in relation to their frequency. The variables studied with relation to the messages or recommended practices included the reception of the messages, their comprehension and adoption.The real adoption and the spontaneous adoption by farmers was studied before the extension service began, in order to study the true influence of the extension service. The variables mentioned were studied for each one of the major

farms in the areas and for each of the principal messages. Based on the responses received, and for each participating farmer surveyed, the following indices were calculated: 1) message reception, 2) message comprehension, 3) adoption prior to the beginning of the service, 4) relative present adoption and 5) absolute present adoption. These indices were calculated by taking into account the pricipal crops or stock of the participating farmer, and for each one individually. As indicators for the indirect evaluation test, the following were taken: 1) intensity of use of credit, 2) intensity of disseminsation, and 3) increased yield based on adoption of the messages. In addition,some characteristics of the participating farmers were studied, such as age, years in farming, degree of education, dependents, size of farm, livestock owned and principal crops. These characteristics were later related to some follow-up and evaluation indicators.

After each of the surveys was applied and reviewed, the data was transferred to coding sheets, although most of the variables were entered without any changes. After coding, the data were processed by a microcomputer, using a specially developed program.

The main conclusions of the study were the following: 1)On the average, the participating farmers in the ARPC IX- Cajamarca have the following characteristics: 47 years old, 24 months working with the extension service; 25% have completed elementary school, while 52% have some elementary schooling. They have an average of 6.5 dependents, but only 2.1 of

the dependents work within the production unit. They posess an average of 8.5 hectares, of which 3.2 are irrigated. 67% of the farmers own cattle, 87% grow corn and 55% potatoes. 2) 91% of the participating farmers in ARPC IX-Cajamarca may be classified as small farmers (between 1 and 20 hectares); 1.5% are minifundistas and 7.4% own more than 20 hectares. 3) Many of the characteristics were studied in relation to comprehension, adoption and dissemination of messages, and their relation to the manner in which the participating farmer grades the extension service. Positive correlation was only found to be highly significant only on the case that the farmer owned cattle and in his adoption of messages with resepect to cattle-raising. 4) The study considered that the effectiveness of the visits was acceptable, since 66.1% of the participating farmers receive visits on a certain day of the week and 71% received vistis from 0 to 15 days prior to the survey. 5) The study found the quality of the visits to be good; they have a duration of 1.71 hours on the average and 3.2 neighboring farmers participate in the visit. 75.2% of the participating farmers receive practical training in their experimental parcels and the 68% that own cattle also recieve practical training through livestock training units. 6) By the date of the survey and in the time in which the Agricultural Campaign had been underway, participating farmers had attended 7.9 group extension activities, which the study considered to be quite low in relation to the ARPC operation plans for the campaign. 7) The study also graded as low the fact that 70% of the messages transmitted by the ARPC IX- Cajamarca are being recieved by participating farmers, since the messages under study were those that had been most insistently repeated. 8) The study gave a high grade to the fact that 82% of the messages received by the participating farmers had been under-

stood by them, taking into account the socio-cultural area in which the ARPC works and considering that the quality of the visits was not optimum. High comprehension indices were obtainedwhen each of the principal types of activities of the ARPC (cattle, corn and potatoes) was analyzed independently, as well as for each of the messages for each type of activity is analyzed. 9) 90% of the messages understood was adopted by the participating farmers (index of relative adoption). This percentage already included 29% of the messages or recommendations already put into practice by the participating farmers before the extension service was begun. This proportion of relative adoption was considered high, taking into account the short amount of time that the extension service had been in effect. 10) On the average for the ARPC, 55% of the messagesevaluated had been adopted (absolute adoption index), which was also considered high, given the short time the service had been in effect. Judging by the index of relative adoption, this index could easily be increased if the reception and understanding of the messages were more effective. 11) 57% of the participating farmers surveyed graded the extension service as very useful, while 24% graded it as useful. Only 1.5% of the participating farmers gave a poor grade to the extension service. Among the most frequent suggestions are those for more frequent visits, more support in the obtention of improved seed and more demonstration fields. 12) 61% of the participating farmers requested credit for the Agrarian Bank and 364 of them received it. It is estimated that use of credit is on the increase, which also indicates a greater use of agricultural materials and the hope for an impact on yield. 74% of the farmers received credit slowly and 64% of them say that the amount received was only part of what had been requested. 13) The study estimated that

there are 5.73 farmers who receive information from the participating farmers, which is considered to be high, given the short existence of the service; the theoretical goal is 10 farmers reached for every participant. The number of farmers reached in ARPC IX-Cajamarca is estimated at 6,226, which represents just 19% of the population of small farmers. The study concludes that there is a good degree of efficiency by a poor degree of effectiveness, given that only 29% of the participating farmers are worked with. 14) The yields of the principal crops (sweet corn and potatoes) and the productivity of the main livestock species (cattle) are still low. However, substantial improvement has been achieved in the case of the participating farmers. The yield of sweet corn among participating farmers rose nearly 63% in the 1983-84 and 1984-85 agricultural campaigns, while potato yield rose 59%. In the case of cattle, comparing the situation prior to the project and the present rate of mortality, the rate has declined from 12.2% to 2.8%, while milk production has increased 20% and meat production increased 26% of standing weight. 15) Considering the increased yields mentioned for participating farmers, the estimated dissemination and increased yields of those benefitting from dissemination (estimated at 40% of those of participating farmers), the increases registered in corn, potatoes and cattle have produced an increase of US$ 1,280,000 in the regional gross product in agriculture, approximately.

1.3 Other Studies

In May, 1984, the Mission form the Israeli Association for International Cooperation, IAIC, developed a methodology for evaluating the activities and

results of agricultural extension.which allows for the evaluation of three main aspects: 1) A situational diagnosis to complement or correct prior diagnoses, in function of the changes produced in the time between the two; 2) The economic contribution of agriculutural extension and promotion to the regional gross internal product for each crop, or the quantification of the benefits provided to the production system; 3) The evaluation of the advancement in the adoption of messages relative to different crops or livestock spec ies, or the degree of achievement of the objectives drawn up for priority crops. The Mission suggests that this type of evaluation could be made constantly on a rotating basis in the different areas of the ARPC, or at intervals, to measure advancement (if any) during the period evaluated.

In order to numerically prove the evaluation methodology of the extension activities elaborated by the IAIC Mission, a pilot study was made in June, 1984 of the methodology in four extension agencies in the ARPC XIV-Cusco. The first part of the study carried out an economic evaluation of the contribution of technology transfer in the ARPC XIV- Cusco and estimated the benefit/cost relation to be 4.5, as follows: 1) Based on the information as to the average area farmed by each participating farmer, the average increase in yield for each crop in each parcel, the number of participating farmers reached by the ARPC, the percentage of farmers producing a given crop and the product price per ton, the overall benefit of generational action and technology transfer for the farmers was estimated for each crop. 2) Numerically, the following benefits were obtained for each crop: potato- 6,719 million soles, corn - 848 million soles, wheat- 336 million soles, fava beans- 225 million soles, for a total of 8,128 million soles. Given that the total

budget for the ARPC XIV-Cusco that year was 1,800 million soles, the study concluded that the benefit/cost relation (8,128 million divided by 1,800 million) was 4.5.

In addditon, the study made some correlations between the percentage of messages adopted and some variables, finding the following results: 1) that the co-relation between the percentage of messages adopted and the educational level of the participating farmers is high, although the low absolute value of the correlation does not permit it to be affirmed that the correlation actual-ly exsists in the environment surveyed; 2) that the correlation between the percentage of messages adopted and the length of time the farmer has been attended by the extension service is also positive, although the absolute value found does not show good adjustment of the data; 3)that there is a positive correlation between the percentage of messages adopted and the age of participating farmers, such that for increased age and perhaps greater experience, the percentage of messages adopted is also greater; 5) that there ia also a positive correlation between the percentage of message adopted and the percentage of land irrigated, which shows that the participating farm-ers increase the level of technology in their farms in a greater proportion. They are also the most likely to accept and adopt the messages offered by the extension service.

2. Evaluation of Results of the Application of Generated Technology

2.1 The 1984 Annual Report

NIARP's 1984 Annual report, entitled "Activities and Achievements of the Nation-

al Institute for Agricultural Research and Promotion", published in 1985, is a synthesis of the diverse internal evaluation studies and activities of the Institute. Although it was not specifically designed as an evaluation document and instrument, the results presented by the Nation Product Programs carried out by the NIARP, in terms of total hectares, total production in metric tons and average productivity (kg./hectare) for each product and each National Program, at the national level and for each ARPC, at the regional level and for the geographic areas covered by the investment projects, comparing the results of 1980 with those obtained in 1984 with respect to the variables mentioned, and comparing these results with the results obtained by participating farmers in 1984, it can be concluded that the Annual Report is really an internal evaluation document of research, extension and promotion activities carried out in the 1980-1984 period.

Table No. 6 compares the yields obtained at the national level for the National Products Programs from 1980 to 1984, as well as the relation to the yields obtained by participating farmers. It can be seen that the yields obtained for rice, potatoes, swwet corn, hard yellow corn, fava and lima beans are significantly higher than the yields obtained in 1980. For wheat and barley, the difference is slightly negative; while for wheat and soybeans, the difference between 1984 and 1980 is significantly negative. All this reflects the priorities imposed by economic and agricultural policies adopted by the government during the period under consideration, In addition, Table 6 compares the national yields obtained

Table No. 6: Comparison of National Yields of Principal National Product Programs from 1980 to 1984, and their Relation to Yields of Participating Farmers

Products	Average National Yield (kg/ha)		(B)/(A) in %	Yield of Participating Farmers (kg/ha)	(D)/(B) in %
	1980 (A)	1984 (B)	(C)	1984 (D)	(E)
Rice	4,271	4,765	11.49	5,637	19.35
Potatoes	7,497	8,446	12.66	15,040	78.07
Sweet Corn	979	1,266	25.23	1,566	27.73
Hard Yellow Corn	2,831	3,219	13.70	4,414	37,12
Beans	874	839	-4.00	1,333	58.88
Fava Beans	1,220	1,250	2.46	1,450	16.00
Lima Beans	654	1,096	67.58	850	-22.44
Soybeans	2,605	1,274	-51.09	1,550	21.66
Wheat	1,215	1,057	-13.00	1,494	41.34
Barley	932	890	-4.51	1,266	37.75

Source: NIAPR Annual Report, 1984

in 1984 for the products under consideration with the yields obtained by participating farmers for the same years. In this case, it can be seen that the yields obtained by participating farmers the same year were significantly higher than the average national yields, except for lima beans. Since "participating farmers" are those directly attended by the NIARP extension service and therefore directly receive the benefits of technology generation and technological packets, the macroeconomic impact can be inferred if the technology generated were to be adopted by all farmers.

Table No. 7 complements Table No. 6 and in addition to information as to average yields from 1980 to 1984 for the same products as those in Table No. 6, in provides information as to the number of hectares cultivated and the total production for each product from 1980 to 1984. The objective of this Table is to show the impact that technology generayion and transfer helps to make on the area cultivated and total production, not just with respect to productivity. The importance of technology in the process of expanding the agricultural boundary by producing seroplasm adapted to new regions and generating other technological knowledge that permits cultivation in rational conditions, is well documented. The most characteristic cases are those of rice, sweet corn, hard yellow corn, beans and wheat, which have contributed substantially to the increase of nearly 180,000 aditional hectares cultivated in 1984, with respect to 1980.

Tables 8 to 14 present the same type of information as Table 7, but re-

NATIONAL TOTAL

Table No 7 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	99,456	227,080	127,624	425,102	1,082,011	656,909	4,274	4,765	491	4,228	
Potatoes	196,175	171,577	(24,598)	1,470,707	1,449,126	21,581	7,497	8,446	949	5,996	
Sweet Corn	156,905	183,474	26,569	153,548	244,860	91,312	979	1,226	247	4,186	
Yellow Corn	133,375	177,329	43,954	377,612	570,760	193,148	2,831	3,219	387	4,177	
Sub-Total	290,280	360,803	70,523			0					
Beans	45,004	57,334	12,330	39,311	48,099	8,788	874	839	(35)	1,878	
Fava Beans	5,048	5,175	127	6,159	6,471	312	1,220	1,250	30	111	
Lima Beans	2,565	2,572	7	1,677	2,820	1,143	654	1,096	443	142	
Soy Beans	2,324	379	(1,945)	6,055	483	(5,572)	2,605	1,274	(1,331)	119	
Sub-Total	54,941	65,460	10,519			0					
Wheat	67,271	75,870	8,599	81,729	80,191	(1,538)	1,215	1,057	(158)	1,985	
Barley	103,515	88,717	(14,798)	96,514	78,989	(17,525)	932	890	(42)	1,235	
Sub-Total	170,755	164,191	(6,564)			0					
TOTAL	811,607	989,113	177,504								

Source: MIATR Anual Report, 1,984

fer to the principal products of each of the National Programs carried out by the NIARP, at both the national level and for every ARPC.

Table No. 15, calculated on the basis of information provided by Table No. 7, presents the geometric rates of yearly growth, expressed in percentages, of the production area and yield of each of the major products which make up the NIARP National Product Programs,from 1980 to 1984. The geometric rates mentioned are used because it is known that the sum of the annual geometric growth rate of area under cultivation and the annual geometric growth rate of yield, added to the product of both those rates, is equal to the annual geometric growth rate of production. It can be seen that the growth of the area under cultivation and the growth of yield per hectare during the period studied are responsible for the increased production of rice,sweet corn, yellow corn, fava and lima beans. The growth in the yield of potatoes com ensates for the decreased area under cultivation, thereby stabilizing the production. In the case of wheat, exactly the opposit occurred; production remained stable due to the fact that increased area under cultivation practically compensated for diminished yields Barley and especially soybeans suffered a strong negative impact in production due to decreased area cultivated and decreased yields.

NATIONAL RICE PROGRAM

Table No 8 Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	22,814	40,218	17,404	129,201	222,003	92,802	5,663	5,520	(143)	900	5,970
II	CHICLAYO	3,655	51,934	48,279	18,500	304,248	285,748	5,062	5,858	796	659	6,138
III	TRUJILLO	2,413	28,121	25,708	10,120	152,624	142,504	4,194	5,427	1,233	331	6,900
IV	HUARAZ	985	3,024	2,039	6,078	18,745	12,667	6,171	6,199	28	67	6,500
V	LIMA											
VI	ICA											
VII	AREQUIPA	9,252	8,656	(596)	74,285	77,825	3,540	8,029	8,991	962	333	9,590
VIII	TACNA											
IX	CAJAMARCA	10,436	14,266	3,830	48,802	75,742	26,940	4,676	5,309	633	202	5,800
X	HOYOBAMBA	24,121	45,430	21,309	96,056	156,195	60,139	3,982	3,438	(544)	1,057	5,000
XI	HUANUCO	1,562	705	(857)	2,979	1,362	(1,617)	1,907	1,932	25	203	2,500
XII	HUANYACO											
XIII	AYACUCHO	168	795	627	243	1,170	927	1,446	1,472	26	13	1,600
XIV	CUSCO	979	900	(79)	1,684	1,625	(59)	1,720	1,806	86	25	1,900
XV	PUNO											
XVI	IQUITOS	14,909	25,510	10,601	22,904	55,350	32,446	1,536	2,170	634	206	5,000
XVII	M. de DIOS	1,662	2,721	1,059	1,900	4,082	2,182	1,143	1,500	357	168	2,800
XVIII	PUCALLPA	6,500	4,800	(1,700)	12,350	11,040	(1,310)	1,900	2,300	400	64	2,800
TOTAL		99,456	227,080	127,624	425,102	1,082,011	656,909	4,274	4,765	491	4,228	5,687

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL POTATO PROGRAM

Table No 9 Comparative Achievements by areas, production and productivity (1980-1984)

	ARFC	Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	1,230	1,294	64	10,973	15,528	4,555	8,921	12,000	3,079	217	12,450
II	CHICLAYO											
III	TRUJILLO	14,349	13,993	(356)	57,404	116,643	59,239	4,001	8,336	4,335	609	15,500
IV	HUARAZ	10,986	13,500	2,514	71,804	125,500	53,696	6,536	9,296	2,760	1,103	11,762
V	LIMA	6,629	4,900	(1,729)	98,731	76,536	(22,195)	14,894	15,620	726	658	28,000
VI	ICA	1,858	1,981	123	31,332	40,850	9,518	16,863	20,621	3,758	85	23,000
VII	AREQUIPA	2,265	2,255	(10)	37,208	40,729	3,521	16,427	18,062	1,635	281	21,000
VIII	TACNA	1,921	1,634	(287)	22,320	19,414	(2,906)	11,619	11,881	262	202	26,000
IX	CAJAMARCA	6,050	15,900	9,850	120,115	108,927	(11,188)	19,854	6,851	(13,003)	289	12,200
X	HOYOBAMBA	968	930	(38)	10,774	12,008	1,234	11,130	12,912	1,782	150	15,900
XI	HUANUCO	27,835	21,073	(6,762)	206,865	190,000	(16,865)	7,432	9,016	1,584	330	12,500
XII	HUANYACO	38,038	41,400	3,362	348,080	381,900	33,820	9,151	9,225	74	567	11,914
XIII	AYACUCHO	9,753	4,960	(4,793)	54,644	25,177	(29,467)	5,603	5,076	(527)	538	12,475
XIV	CUSCO	34,888	31,452	(3,436)	223,726	202,008	(21,718)	6,413	6,423	10	573	12,000
XV	PUNO	39,405	16,305	(23,100)	176,731	93,906	(82,825)	4,484	5,759	1,275	394	8,000
XVI	IQUITOS											
XVII	M. de DIOS											
XVIII	PUCALLPA											
TOTAL		196,175	171,577	(24,598)	1,470,707	1,449,126	(21,581)	7,497	8,446	7,750 0	5,996	15,040

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL CORN PROGRAM

SWEET CORN

Table No 10 Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	7,355	8,132	777	5,458	5,949	491	742	732	(10)	524	1,200
II	CHICLAYO	3,066	2,266	(800)	2,970	2,582	(388)	969	1,139	170		
III	TRUJILLO	2,672	4,165	1,493	2,442	3,799	1,357	914	912	(2)	320	1,500
IV	HUARAZ	11,881	11,580	(301)	16,032	15,621	(411)	1,349	1,349	0	913	1,561
V	LIMA	1,994	985	(1,009)	2,976	1,667	(1,309)	1,492	1,692	200	104	2,000
VI	ICA											
VII	AREQUIPA	3,414	3,473	59	6,995	7,163	168	2,049	2,062	13	267	2,196
VIII	TACNA	3,020	1,780	(1,240)	5,246	2,997	(2,249)	1,737	1,684	(53)	88	3,000
IX	CAJAMARCA	34,400	52,497	18,097	13,173	64,893	51,720	383	1,236	853	404	1,850
X	HOYOBAMBA	11,660	14,400	2,740	11,877	20,783	8,906	1,019	1,443	424	150	1,600
XI	HUANUCO	7,607	6,712	(895)	7,970	8,000	30	1,048	1,192	144	260	1,500
XII	HUANYACO	11,598	25,488	13,890	11,667	30,586	18,919	1,007	1,200	193	189	1,290
XIII	AYACUCHO	16,541	9,354	(7,187)	10,807	6,672	(4,135)	653	713	60	495	1,051
XIV	CUSCO	40,598	41,317	719	54,928	53,007	(1,921)	1,353	1,283	(70)	422	1,800
XV	PUNO	1,099	1,325	226	997	1,141	144	907	861	(46)	50	1,200
XVI	IQUITOS											
XVII	M. de DIOS											
XVIII	PUCALLPA											
TOTAL		156,905	183,474	26,569	153,538	224,860	71,322	979	1,226	247	4,186	1,566

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL CORN PROGRAM

HARD YELLOW CORN

Table No II Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	10,482	10,542	60	28,280	44,760	16,480	2,698	4,246	1,548	723	4,500
II	CHICLAYO	4,467	12,565	8,098	11,086	42,458	31,372	2,482	3,379	897	298	3,672
III	TRUJILLO	4,672	12,402	7,730	14,219	57,271	43,052	3,043	4,618	1,575	429	4,700
IV	HUARAZ	7,209	11,869	4,660	28,852	52,337	23,485	4,002	4,410	408	348	4,600
V	LIMA	16,609	27,638	11,029	69,083	119,054	49,971	4,159	4,308	149	1,053	5,900
VI	ICA	5,349	8,327	2,978	19,949	30,710	10,761	3,729	3,688	(41)	50	4,000
VII	AREQUIPA	377	1,155	778	1,111	3,501	2,390	2,947	3,031	84		
VIII	TACNA	544	507	(37)	2,163	1,425	(738)	3,976	2,811	(1,165)	88	4,000
IX	CAJAMARCA	16,106	13,386	(2,720)	39,223	35,965	(3,258)	2,435	2,687	252	455	3,500
X	HUYOBAMBA	33,600	56,298	22,698	72,600	112,918	40,318	2,161	2,006	(155)		
XI	HUANUCO	3,564	4,726	1,162	7,398	9,442	2,044	2,076	1,998	(78)	104	2,400
XII	HUANYACO	12,734	3,285	(9,449)	12,734	3,285	(9,449)	1,000	1,000	0	214	4,060
XIII	AYACUCHO	3,342	2,168	(1,174)	3,684	4,680	996	1,102	2,159	1,057	21	3,500
XIV	CUSCO	5,198	3,603	(1,595)	7,390	6,313	(1,077)	1,422	1,752	330	111	3,500
XV	PUNO											
XVI	IQUITOS	5,212	5,804	592	7,122	9,292	2,170	1,366	1,601	235	128	1,800
XVII	M. de DIOS	510	940	430	698	1,411	713	1,369	1,501	132	109	2,000
XVIII	PUCALLPA	3,400	2,114	(1,286)	52,020	35,938	(16,082)	1,530	1,700	170	46	1,850
TOTAL		133,375	177,329	43,954	377,612	570,760	193,148	2,831	3,218	387	4,177	4,414

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL LEGUMES PROGRAM

BEANS

Table No 12 Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	3,936	2,897	(1,039)	2,902	1,755	(1,147)	737	606	(131)	212	1,070
II	CHICLAYO	3,294	957	(2,337)	1,784	761	(1,023)	542	795	253	0	0
III	TRUJILLO	1,049	1,443	394	1,124	1,267	143	1,071	878	(193)	257	1,290
IV	HUARAZ	1,590	1,560	(30)	2,174	2,083	(91)	1,367	1,335	(32)	202	1,550
V	LIMA	3,384	2,329	(1,055)	4,271	2,522	(1,749)	1,262	1,083	(179)	401	1,500
VI	ICA	1,113	965	(148)	939	1,136	197	844	1,177	333	80	1,450
VII	AREQUIPA	6,877	7,355	478	8,683	10,057	1,374	1,263	1,367	104	186	1,600
VIII	TACNA											
IX	CAJAMARCA	9,668	25,626	15,958	5,000	14,976	9,976	517	584	67	3	800
X	HOYOBAMBA	4,053	4,994	941	2,985	5,104	2,119	736	1,022	286	39	1,100
XI	HUANUCO	3,084	1,220	(1,864)	3,145	1,165	(1,980)	1,020	955	(65)	129	1,200
XII	HUANYACO	2,118	1,972	(146)	1,838	1,817	(21)	868	921	53	47	1,290
XIII	AYACUCHO	648	1,709	1,061	598	1,314	716	923	769	(154)	37	1,100
XIV	CUSCO	1,546	1,547	1	1,376	1,425	49	890	921	31	40	1,500
XV	PUNO											
XVI	IQUITOS	1,481	1,977	496	1,516	1,983	467	1,024	1,003	(21)	77	1,050
XVII	M. de DIOS	10	105	95	8	84	76	800	800	0	48	1,300
XVIII	PUCALLPA	1,153	678	(475)	968	650	(318)	840	959	119	50	1,100
TOTAL		45,004	57,334	12,330	39,311	48,099	8,788	874	839	(35)	1,808	1,332

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL CEREALS PROGRAM

WHEAT

Table No 13 Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA	6,320	7,128	808	6,550	5,696	(854)	1,036	799	(237)	215	1,050
II	CHICLAYO											
III	TRUJILLO	8,302	15,994	7,692	7,647	15,577	7,930	921	974	53	464	1,200
IV	HUARAZ	12,640	12,009	(631)	14,643	13,600	(1,043)	1,158	1,132	(26)	595	1,476
V	LIMA	31	396	365	96	471	375	3,097	1,189	(1,908)	0	0
VI	ICA	338	37	(301)	710	39	(671)	2,101	1,054	(1,047)	54	1,730
VII	AREQUIPA	745	420	(325)	1,644	869	(775)	2,207	2,069	(138)	45	2,269
VIII	TACNA											
IX	CAJAMARCA	4,600	11,278	6,678	10,260	10,465	205	2,230	928	(1,302)	134	900
X	HOYOBAMBA											
XI	HUANUCO	4,041	3,010	(1,031)	5,893	3,814	(2,079)	1,458	1,267	(191)	62	1,600
XII	HUANYACO	13,598	13,060	(538)	18,540	18,292	(248)	1,363	1,401	38	95	1,626
XIII	AYACUCHO	6,941	5,186	(1,755)	4,440	3,692	(748)	640	712	72	127	995
XIV	CUSCO	9,715	7,352	(2,363)	11,306	7,676	(3,630)	1,164	1,044	(120)	194	2,200
XV	PUNO											
XVI	IQUITOS											
XVII	M. de DIOS											
XVIII	PUCALLPA											
TOTAL		67,271	75,870	8,599	81,729	80,191	(1,538)	1,215	1,057	(158)	1,985	1,494

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

NATIONAL CEREALS PROGRAM

BARLEY

Table No 14 Comparative Achievements by areas, production and productivity (1980-1984)

ARPC		Total Hectares			Total Prod. in Metric Tons			Average Productivity Kg/Hs			Participation Farmers in 1984(*)	
		1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.(**)
I	PIURA											
II	CHICLAYO											
III	TRUJILLO	5,874	11,346	5,472	3,954	10,447	6,493	673	921	248	337	1,280
IV	HUARAZ	7,722	8,602	880	8,371	5,030	(3,341)	1,084	585	(499)	476	1,332
V	LIMA											
VI	ICA											
VII	AREQUIPA											
VIII	TACNA											
IX	CAJAMARCA	15,148	9,579	(5,569)	9,684	7,595	(2,089)	639	793	154	102	850
X	HOYOBAMBA											
XI	HUANUCO											
XII	HUANYACO	28,000	25,000	(3,000)	35,756	30,000	(5,756)	1,276	1,200	(76)	0	0
XIII	AYACUCHO	17,922	3,591	(14,331)	12,934	2,393	(10,541)	722	666	(56)	117	1,120
XIV	CUSCO	12,761	15,378	2,617	14,675	12,399	(2,276)	1,150	806	(344)	98	1,500
XV	PUNO	16,088	15,221	(867)	11,140	11,125	(15)	692	731	39	105	800
XVI	IQUITOS											
XVII	M. de DIOS											
XVIII	PUCALLPA											
TOTAL		103,515	88,717	(14,798)	96,514	78,989	(17,525)	932	890	(42)	1,235	1,226

(*) Refers to farmers attended directly by NIARP Extension Service.
(**) Average productivity in parcels of participating farmers, obtained in 1984.

Source: NIATR Anual Report, 1,984

Table No. 15 Geometric Annual growth rates (in %) of Production, Area and yield of Selected Products (1980-84)

PRODUCTS	Annual Geometric Growth Rates (in %)		
	Products	Area	Yield
Rice	26.30	22.92	2.76
Potato	0.37	(3.29)	3.02
Sweet Corn	10.01	3.99	5.79
Yellow Corn	10.88	7.38	3.26
Beans	5.17	6.24	(1.02)
Fava Beans	1.24	0.60	0.61
Lima Beans	13.88	0.07	13.78
Soybeans	(46.85)	(36.45)	16.37
Wheat	0.47	3.05	3.42
Barley	(4.89)	(3.78)	(1.15)

Source: Table No. 7.

Tables Nos. 16 to 33 present the same type of information as Table No. 7, but separated by National Program product for each ARPC. Tables Nos. 34, 35 and 36 give the same type of information, but in aggregate form for each natural region of the country (coast, highlands and jungle). Tables Nos. 37,38 and 39 present the same type of information, consolidated by each one of the NIARP's large investment projects (ARE Project, World Bank; REE Project, AID; SPASP Project, IDB).

Table No. 40 presents the annual geometric growth rates, in percentages, for areas cultivated between 1980 and 1984, at the level of natural regions and for each NIARP investment project (See Map 1). It can be seen that the area cultivated with products mentioned in Table 7 grew at rather high rates during the period under consideration for the coastal and jungle regions, while the highland regionn remained relatively constant. The area cultivated in the regions corresponding to the World Ban ARE Project and the AID REE Project also grew at high rates, while the cultivated area for the IDB SPASP Project diminished at an annual rate of 5.07%.

Based on the information in Tables 34,35 and 36, Table No. 41 presents the estimates for the annual geometric growth rates, in percentages, from 1980 to 1984 for the products mentioned in Table No. 7 by natural region. In other words, Table No. 41 presents separated information as to the geometric rates gicen in Table No. 15. Finally, Table No. 42, calculated on the basis of the information given in Tables Nos. 37, 38 and 39, presents the geometric growth rates, in percentages of production, area and

ARPC I PIRUA

Table No 16 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	22,814	40,218	17,404	129,201	222,003	92,802	5,663	5,520	(143)	900	5,970
Barley											
Beans	3,936	2,897	(1,039)	2,902	1,755	(1,147)	737	606	(131)	212	1,070
Fava Beans											
Sweet Corn	7,355	8,132	777	5,458	5,949	491	742	732	(10)	524	1,200
Yelow Corn	10,482	10,542	60	28,280	44,760	16,480	2,698	4,246	1,548	723	4,500
Potato	1,230	1,294	64	10,973	15,528	4,555	8,921	12,000	3,079	217	12,450
Soybean	2,324	379	(1,945)	6,055	483	(5,572)	2,605	1,274	(1,331)	119	1,550
Wheat	6,320	7,128	808	6,550	5,696	(854)	1,036	799	(237)	215	1,050
TOTAL	54,461	70,590	16,129								

Source: NIATR Anual Report, 1,984

ARPC II CHICLAYO

Table No 17 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	3,655	51,934	48,279	18,500	304,248	285,748	5,062	5,858	796	659	6,138
Barley											
Beans	3,294	957	(2,337)	1,784	761	(1,023)	542	795	253		
Fava Beans											
Sweet Corn	3,066	2,266	(800)	2,970	2,582	(388)	969	1,139	170		
Yelow Corn	4,467	12,565	8,098	11,086	42,458	31,372	2,482	3,379	897	298	3,672
Potato											
Soybean											
Wheat											
TOTAL	14,482	67,722	53,240								

Source: NIATR Anual Report, 1,984

ARPC III TRUJILLO

Table No 18 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	2,413	28,121	25,708	10,120	152,624	142,504	4,194	5,427	1,233	331	6,900
Barley	5,874	11,346	5,472	3,954	10,447	6,493	673	921	248	337	1,280
Beans	1,049	1,443	394	1,124	1,267	143	1,071	878	(193)	257	1,290
Fava Beans											
Sweet Corn	2,672	4,165	1,493	2,442	3,799	1,357	914	912	(2)	320	1,500
Yelow Corn	4,672	12,402	7,730	14,219	57,271	43,052	3,043	4,618	1,575	429	4,700
Potato	14,349	13,993	(356)	57,404	116,643	59,239	4,001	8,336	4,335	609	15,500
Soybean											
Wheat	8,302	15,994	7,692	7,647	15,577	7,930	921	974	53	464	1,200
TOTAL	39,331	87,464	48,133								

Source: NIATR Anual Report, 1,984

ARPC IV HUARAZ

Table No 19 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	985	3,024	2,039	6,078	18,745	12,667	6,171	6,199	28	67	6,500
Barley	7,722	8,602	880	8,371	5,030	(3,341)	1,084	585	(499)	476	1,332
Beans	1,590	1,560	(30)	2,174	2,083	(91)	1,367	1,335	(32)	202	1,550
Fava Beans											
Sweet Corn	11,881	11,580	(301)	16,032	15,621	(411)	1,349	1,349	0	913	1,561
Yelow Corn	7,209	11,869	4,660	28,852	52,337	23,485	4,002	4,410	408	348	4,600
Potato	10,986	13,500	2,514	71,804	125,500	53,696	6,536	9,296	2,760	1,103	11,762
Soybean											
Wheat	12,640	12,009	(631)	14,643	13,600	(1,043)	1,158	1,132	(26)	595	1,476
TOTAL	53,013	62,144	9,131								

Source: NIATR Anual Report, 1,984

ARPC V LIMA

Table No 20 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice											
Barley											
Beans	3,384	2,329	(1,055)	4,271	2,522	(1,749)	1,262	1,083	(179)	401	1,500
Fava Beans											
Sweet Corn	1,994	985	(1,009)	2,976	1,667	(1,309)	1,492	1,692	200	104	2,000
Yelow Corn	16,609	27,638	11,029	69,083	119,054	49,971	159	4,308	4,149	1,053	5,900
Potato											
Soybean											
Wheat	31	396	365	96	471	375	3,097	1,189	(1,908)		
TOTAL	22,018	31,348	9,330								

Source: NIATR Anual Report, 1,984

ARPC VI ICA

Table No 21 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice											
Barley											
Beans	1,113	965	(148)	939	1,136	197	844	1,177	333	80	1,450
Fava Beans											
Sweet Corn											
Yelow Corn	5,349	8,327	2,978	29,949	30,710	761	3,729	3,688	(41)	50	4,000
Potato	1,858	1,981	123	31,332	40,850	9,518	16,863	20,621	3,758	85	23,000
Soybean	2,565	2,572	7	1,677	2,820	1,143	654	1,096	442	142	850
Wheat	338	37	(301)	710	39	(671)	2,101	1,054	(1,047)	54	1,730
TOTAL	11,223	13,882	2,659								

Source: NIATR Anual Report, 1,984

ARPC VII AREQUIPA

Table No 22 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	9,252	8,656	(596)	74,285	77,825	3,540	8,029	8,991	962	333	9,590
Barley											
Beans	6,877	7,355	478	8,683	10,057	1,374	1,263	1,367	104	186	1,600
Fava Beans											
Sweet Corn	3,414	3,473	59	6,995	7,163	168	2,049	2,062	13	267	2,196
Yelow Corn	377	1,155	778	1,111	3,501	2,390	2,947	3,031	84		
Potato	2,265	2,255	(10)	37,208	40,729	3,521	16,427	18,062	1,635	281	21,000
Soybean											
Wheat	745	420	(325)	1,644	869	(775)	2,207	2,069	(138)	45	2,269
TOTAL	22,930	23,314	384								

Source: NIATR Anual Report, 1,984

ARPC VIII TACHA

Table No 23 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice											
Barley											
Beans											
Fava Beans											
Sweet Corn	3,020	1,780	(1,240)	5,246	2,997	(2,249)	1,737	1,684	(53)	88	3,000
Yelow Corn	544	507	(37)	2,163	1,425	(738)	3,976	2,811	(1,165)	88	4,000
Potato	1,921	1,634	(287)	22,320	19,414	(2,906)	11,619	11,881	262	202	26,000
Soybean											
Wheat											
TOTAL	5,485	3,921	(1,564)								

Source: NIATR Anual Report, 1,984

ARPC IX CAJAMARCA

Table No 24 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	10,436	14,266	3,830	48,802	75,742	26,940	4,676	5,309	633	202	5,800
Barley	15,148	9,579	(5,569)	9,684	7,595	(2,089)	639	793	154	102	850
Beans	9,668	25,626	15,958	5,000	14,976	9,976	517	584	67	73	800
Fava Beans											
Sweet Corn	34,400	52,497	18,097	13,173	64,893	51,720	383	1,236	853	404	1,850
Yelow Corn	16,106	13,386	(2,720)	39,223	35,965	(3,258)	2,435	2,687	252	455	3,500
Potato	6,050	15,900	9,850	120,115	108,927	(11,188)	19,854	6,851	(13,003)	289	12,200
Soybean											
Wheat	4,600	11,278	6,678	10,260	10,465	205	2,230	928	(1,302)	134	900
TOTAL	96,408	142,532	46,124								

Source: NIATR Anual Report, 1,984

ARPC X HOYOBAMBA

Table No 25 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	24,121	45,430	21,309	96,056	156,195	60,139	3,982	3,438	(544)	1,057	5,800
Barley											
Beans	4,053	4,994	941	2,985	5,104	2,119	736	1,022	286	39	1,100
Fava Beans											
Sweet Corn	11,660	14,400	2,740	11,877	20,783	8,906	1,019	1,443	424	150	1,600
Yelow Corn	33,600	56,298	22,698	72,600	112,918	40,318	2,161	2,006	(155)		
Potato											
Soybean											
Wheat											
TOTAL	73,434	121,122	47,688								

Source: NIATR Anual Report, 1,984

ARPC XI HUANUCO

Table No 26 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	1,562	705	(857)	2,979	1,362	(1,617)	1,907	1,932	25	203	2,500
Barley											
Beans	3,084	1,220	(1,864)	3,145	1,165	(1,980)	1,020	955	(65)	129	1,200
Fava Beans											
Sweet Corn	7,607	6,712	(895)	7,970	8,000	30	1,048	1,192	144	260	1,500
Yelow Corn	3,564	4,726	1,162	7,398	9,442	2,044	2,076	1,998	(78)	104	2,400
Potato	27,835	21,073	(6,762)	206,865	190,000	(16,865)	7,432	9,016	1,584	330	12,500
Soybean											
Wheat	4,041	3,010	(1,031)	5,893	3,814	(2,079)	1,458	1,267	(191)	62	1,600
TOTAL	47,693	37,446	(10,247)								

Source: NIATR Anual Report, 1,984

ARPC XII HUANCAYO

Table No 27 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	38,038	41,400	3,362	348,080	381,900	33,820	9,151	9,225	74	567	11,914
Barley	28,000	25,000	(3,000)	35,756	30,000	(5,756)	1,277	1,200	(77)		
Beans	2,118	1,972	(146)	1,838	1,817	(21)	868	921	53	47	1,290
Fava Beans											
Sweet Corn	11,598	25,488	13,890	11,677	30,586	18,909	1,007	1,200	193	189	1,290
Yelow Corn	12,734	3,285	(9,449)	12,734	3,285	(9,449)	1,000	1,000	0	214	4,060
Potato	38,038	41,400	3,362	348,080	381,900	33,820	9,151	9,225	74	567	11,914
Soybean											
Wheat	13,598	13,060	(538)	18,540	18,292	(248)	1,363	1,401	38	95	1,626
TOTAL	144,124	151,605	7,481								

Source: NIATR Anual Report, 1,984

ARPC XIII AYACUCHO

Table No 28 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	168	795	627	243	1,170	927	1,446	1,472	26	13	1,600
Barley	17,922	3,591	(14,331)	12,934	2,293	(10,641)	722	666	(56)	117	1,120
Beans	648	1,709	1,061	598	1,314	716	923	769	(154)	37	1,100
Fava Beans											
Sweet Corn	16,541	9,354	(7,187)	10,807	6,672	(4,135)	653	713	60	495	1,051
Yelow Corn	3,342	2,168	(1,174)	3,684	4,680	996	1,102	2,159	1,057	21	3,500
Potato	9,753	4,960	(4,793)	54,644	25,177	(29,467)	5,603	5,076	(527)	538	12,475
Soybean											
Wheat	6,941	5,186	(1,755)	4,440	3,692	(748)	640	712	72	127	995
TOTAL	55,315	27,763	(27,552)								

Source: NIATR Anual Report, 1,984

ARPC XIV CUSCO

Table No 29 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	979	900	(79)	1,684	1,625	(59)	1,720	1,806	86	25	1,900
Barley	12,761	15,378	2,617	14,675	12,399	(2,276)	1,150	806	(344)	98	1,500
Beans	1,546	1,547	1	1,376	1,425	49	890	921	31	40	1,500
Fava Beans	5,048	5,175	127	6,159	6,471	312	1,220	1,250	30	111	1,450
Sweet Corn	40,598	41,317	719	54,928	53,007	(1,921)	1,353	1,283	(70)	422	1,800
Yelow Corn	5,198	3,603	(1,595)	7,390	6,313	(1,077)	1,422	1,752	330	111	3,500
Potato	34,888	31,452	(3,436)	223,726	202,008	(21,718)	6,413	6,423	10	573	12,000
Soybean											
Wheat	9,715	7,352	(2,363)	11,306	7,676	(3,630)	1,164	1,044	(120)	194	2,200
TOTAL	110,733	106,724	(4,009)								

Source: NIATR Anual Report, 1,984

ARPC XV FUND

Table No 30 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice											
Barley	16,088	15,221	(867)	11,140	11,125	(15)	692	731	39	105	800
Beans											
Fava Beans											
Sweet Corn	1,099	1,325	226	997	1,141	144	907	861	(46)	50	1,200
Yelow Corn											
Potato	39,405	16,305	(23,100)	176,731	93,906	(82,825)	4,485	5,759	1,274	394	8,000
Soybean											
Wheat											
TOTAL	56,592	32,851	(23,741)								

Source: NIATR Anual Report, 1,984

ARPC XVI IQUITOS

Table No 31 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	14,909	25,510	10,601	22,904	55,350	32,446	1,536	2,170	634	206	500
Barley											
Beans	1,481	1,977	496	1,516	1,983	467	1,024	1,003	(21)	77	1,050
Fava Beans											
Sweet Corn											
Yelow Corn	5,212	5,804	592	7,122	9,292	2,170	1,366	1,601	235	128	1,800
Potato											
Soybean											
Wheat											
TOTAL	21,602	33,291	11,689								

Source: NIATR Anual Report, 1,984

ARPC XVII MADRE DE DIOS

Table No 32 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1,984	Diff.	No	Prod.
Rice	1,662	2,721	1,059	1,900	4,082	2,182	1,143	1,500	357	168	2,800
Barley											
Beans	10	105	95	8	84	76	800	800	0	48	1,300
Fava Beans											
Sweet Corn											
Yelow Corn	510	940	430	698	1,411	713	1,369	1,501	132	109	2,000
Potato											
Soybean											
Wheat											
TOTAL	2,182	3,766	1,584								

Source: NIATR Anual Report, 1,984

ARPC XVIII PUCALLPA

Table No 33 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1,984	Diff.	No	Prod.
Rice	6,500	4,800	(1,700)	12,350	11,040	(1,310)	1,900	2,300	400	64	2,800
Barley											
Beans	1,153	678	(475)	968	650	(318)	840	959	119	50	1,100
Fava Beans											
Sweet Corn											
Yelow Corn	3,400	2,114	(1,286)	52,020	35,938	(16,082)	1,530	1,700	170	46	1,850
Potato											
Soybean											
Wheat											
TOTAL	11,053	7,592	(3,461)								

Source: NIATR Anual Report, 1,984

COASTAL REGION: CONSOLIDATED

Table No 34 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	28,882	120,273	91,391	157,821	678,875	521,054	5,464	5,644	180	1,890	6,191
Barley	5,874	11,346	5,472	3,954	10,447	6,493	673	921	248	337	1,280
Beans	12,776	8,591	(4,185)	11,020	7,441	(3,579)	863	866	3	950	1,343
Fava Beans	2,565	2,572	7	1,677	2,820	1,143	654	1,096	442	142	850
Sweet Corn	18,107	17,328	(779)	19,092	16,994	(2,098)	1,054	981	(73)	1,036	1,526
Yelow Corn	42,123	71,981	29,858	144,780	295,678	150,898	3,437	4,108	671	2,641	4,971
Potato	25,987	23,802	(2,185)	220,760	268,971	48,211	8,495	11,300	2,805	1,771	21,328
Soybean	2,324	379	(1,945)	60,055	483	(59,572)	2,605	1,274	(1,331)	119	1,550
Wheat	14,991	23,555	8,564	15,003	21,783	6,780	1,001	925	(76)	733	1,195
TOTAL	153,629	279,827	126,198								

The region includes the ARPCs at: PIURA, CHICLAYO, TRUJILLO, LIMA, ICA, TACNA.

Source: NIATR Anual Report, 1,984

HIGHLAND REGION: CONSOLIDATED

Table No 35 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	23,382	28,346	4,964	134,071	176,469	42,398	5,734	6,226	492	843	6,378
Barley	97,641	77,371	(20,270)	92,560	68,542	(24,018)	948	886	(62)	898	1,206
Beans	25,531	40,989	15,458	22,814	32,837	10,023	894	801	(93)	714	1,380
Fava Beans	5,048	5,175	127	6,159	6,471	312	1,220	1,250	30	111	1,450
Sweet Corn	127,138	151,746	24,608	122,579	187,083	64,504	964	1,233	269	3,000	1,578
Yelow Corn	48,530	40,192	(8,338)	100,392	115,523	15,131	2,069	2,874	805	1,253	3,810
Potato	169,220	146,845	(22,375)	1,239,173	1,168,147	(71,026)	7,323	7,955	632	4,075	12,275
Soybean											
Wheat	52,280	52,315	35	66,726	58,408	(8,318)	1,276	1,116	(160)	1,252	1,524
TOTAL	548,770	542,979	(5,791)								

The region includes the ARPCs at: CAJAMARCA, HUANUCO, HUARAZ, HUANCAYO, AREQUIPA, AYACUCHO, CUSCO, PUNO.

Source: NIATR Anual Report, 1,984

HUNGLE REGION: CONSOLIDATED

Table No 36 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	47,192	78,461	31,269	133,210	226,667	93,457	2,823	2,889	66	1,495	4,659
Barley											
Beans	6,697	7,754	1,057	5,477	7,821	2,344	818	1,009	191	214	1,127
Fava Beans											
Sweet Corn	11,660	14,400	2,740	11,877	20,783	8,906	1,019	1,443	424	150	1,600
Yelow Corn	42,722	65,156	22,434	132,440	159,559	27,119	3,100	2,449	(651)	283	1,885
Potato	968	930	(38)	10,774	12,008	1,234	11,130	12,912	1,782	150	15,900
Soybean											
Wheat											
TOTAL	109,239	166,701	57,462								

The region includes the ARPCs at: MOYOBAMBA, IQUITOS, MADRE DE DIOS, PUCAALPA.

Source: NIATR Anual Report, 1,984

NIARP - BIRF AGREEMENT

Table No 37 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Formers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	40,303	137,563	97,260	212,701	773,362	560,661	5,278	5,622	344	2,159	6,164
Barley	28,744	29,527	783	22,009	23,072	1,063	766	781	15	915	1,259
Beans	19,537	32,483	12,946	12,984	20,842	7,858	665	642	(23)	744	1,250
Fava Beans											
Sweet Corn	59,374	78,640	19,266	40,075	92,844	52,769	675	1,181	506	2,161	1,518
Yelow Corn	42,936	60,764	17,828	121,660	231,791	110,131	2,834	3,831	997	2,253	4,242
Potato	32,615	44,687	12,072	260,296	366,598	106,302	7,981	8,204	223	2,218	12,913
Soybean	2,324	379	(1,945)	6,055	483	(5,572)	2,605	1,274	(1,331)	119	1,550
Wheat	31,862	46,409	14,547	39,100	45,338	6,238	1,227	977	(250)	1,408	1,265
TOTAL	257,695	430,452	172,757								

The region includes the ARPCs at: PIURA, CHICLAYO, TRUJILLO, HUARAZ, CAJAMARCA.

Source: NIATR Anual Report, 1,984

NIARP - AID AGREEMENT

REE PROYECT

Table No 38 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	47,192	78,461	31,269	133,210	226,667	93,457	2,823	2,889	66	1,495	4,659
Barley	28,000	25,000	(3,000)	357,506	300,000	(57,506)	1,277	1,200	(77)		
Beans	13,312	13,020	(292)	12,525	13,296	771	941	1,021	80	742	1,374
Fava Beans											
Sweet Corn	25,252	40,873	15,621	26,530	53,036	26,506	1,051	1,298	247	443	1,562
Yelow Corn	77,414	104,406	26,992	234,206	312,608	78,402	3,025	2,994	(31)	1,600	4,884
Potato	47,493	49,211	1,718	488,917	511,294	22,377	10,295	10,390	95	1,460	20,219
Soybean	2,565	2,572	7	1,677	2,820	1,143	654	1,096	442	142	850
Wheat	13,967	13,493	(474)	19,346	18,802	(544)	1,385	1,393	8	149	1,664
TOTAL	255,195	327,036	71,841								

The region includes the ARPCs at: LIMA, ICA, HOYOBAMBA, HUANCAYO, PUCALLPA, MADRE DE DIOS, IQUITOS.

Source: NIATR Anual Report, 1,984

NIARP - IDB AGREEMENT

PEPSA

Table No 39 Comparative Achievements by areas, production and productivity (1980-1984)

CROPS	Total Hectares			Total Prod. in Metric Tons			Average Productivity			Participation Farmers in 1984	
	1,980	1,984	Diff.	1,980	1,984	Diff.	1,980	1.984	Diff.	No	Prod.
Rice	11,961	11,056	(905)	79,191	81,982	2,791	6,621	7,415	794	574	6,567
Barley	46,771	34,190	(12,581)	38,749	25,917	(12,832)	828	737	(91)	320	1,131
Beans	12,155	11,831	(324)	13,802	13,961	159	1,135	1,180	45	392	1,411
Fava Beans	5,048	5,171	123	6,159	6,471	312	1,220	1,250	30	111	1,450
Sweet Corn	72,279	63,961	(8,318)	86,943	78,980	(7,963)	1,203	1,235	32	1,582	1,631
Yelow Corn	13,025	12,159	(866)	21,746	25,361	3,615	1,670	2,086	416	324	3,283
Potato	116,067	77,679	(38,388)	721,494	571,234	(150,260)	6,216	7,354	1,138	2,318	13,813
Soybean											
Wheat	21,442	15,968	(5,474)	23,283	16,051	(7,232)	1,086	1,005	(81)	428	2,372
TOTAL	298,748	232,015	(66,733)								

The region includes the ARPCs at: AREQUIPA, TACNA, CUSCO, PUNO, HUANUCO, AYACUCHO.

Source: NIATR Anual Report, 1,984

cultivation from 1980 to 1984, by ARPC, Natural Region and Investment Project.

ARPC		Growth Rate of Area Cultivated
I	PIURA	6.70
II	CHICLAYO	47.50
III	TRUJILLO	22.12
IV	HUARAZ	4.05
V	LIMA	5.80
VI	ICA	5.46
VII	AREQUIPA	0.42
VIII	TACNA	(8.05)
IX	CAJAMARCA	10.27
X	HOYOBAMBA	13.17
XI	HUANUCO	(5.87)
XII	HUANYACO	0.98
XIII	AYACUCHO	(15.83)
XIV	CUSCO	(0.92)
XV	PUNO	(12.71)
XVI	IQUITOS	11.42
XVII	M. de DIOS	14.62
XVIII	PUCALLPA	8.96
Coastal Region		16.14
Highland Region		(0.26)
Jungle Region		11.14
AFE - BIRF Project Region		13.69
AEE - AID Project Region		6.37
I.D.B. Project Region		(6.12)

Table No 41 Annual Geographic Growth Rates (in %) of production area and yield, from 1980 to 1984 for selected products, by natural region.

Annual Geometric Growth Rates (%)

PRODUCTS	COAST			HIGHLANDS			JUNGLE			TOTAL		
	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield
Rice	44.01	42.85	0.81	7.11	4.93	2.08	14.21	13.55	0.58	26.30	22.92	2.76
Barley	27.50	17.89	8.16	(7.23)	(5.65)	(1.68)				(4.89)	(3.78)	(1.15)
Beans	(9.35)	(9.45)	0.09	9.53	12.56	(2.71)	9.32	3.73	5.39	5.17	6.24	(1.02)
Fava Beans				1.24	0.60	0.61				1.24	0.60	0.61
Sweet Corn	(2.86)	(1.09)	(1.78)	11.15	4.52	6.35	15.01	5.41	9.09	10.01	3.99	5.79
Yelow Corn	19.54	14.33	4.56	3.57	(4.60)	8.56	4.77	11.13	(5.72)	10.88	7.38	3.26
Lima Beans	13.88	0.07	13.78							13.88	0.07	13.78
Potato	5.06	(2.17)	7.39	(1.46)	(3.48)	2.09	2.75	(1.00)	3.78	(0.37)	(3.29)	3.02
Soybean	(46.85)	(36.45)	(16.37)							(46.85)	(36.45)	(16.37)
Wheat	9.77	11.96	(1.95)	(3.27)	0.02	(3.29)				(0.47)	3.05	(3.42)
TOTAL		16.14			(0.26)			11.14			5.07	

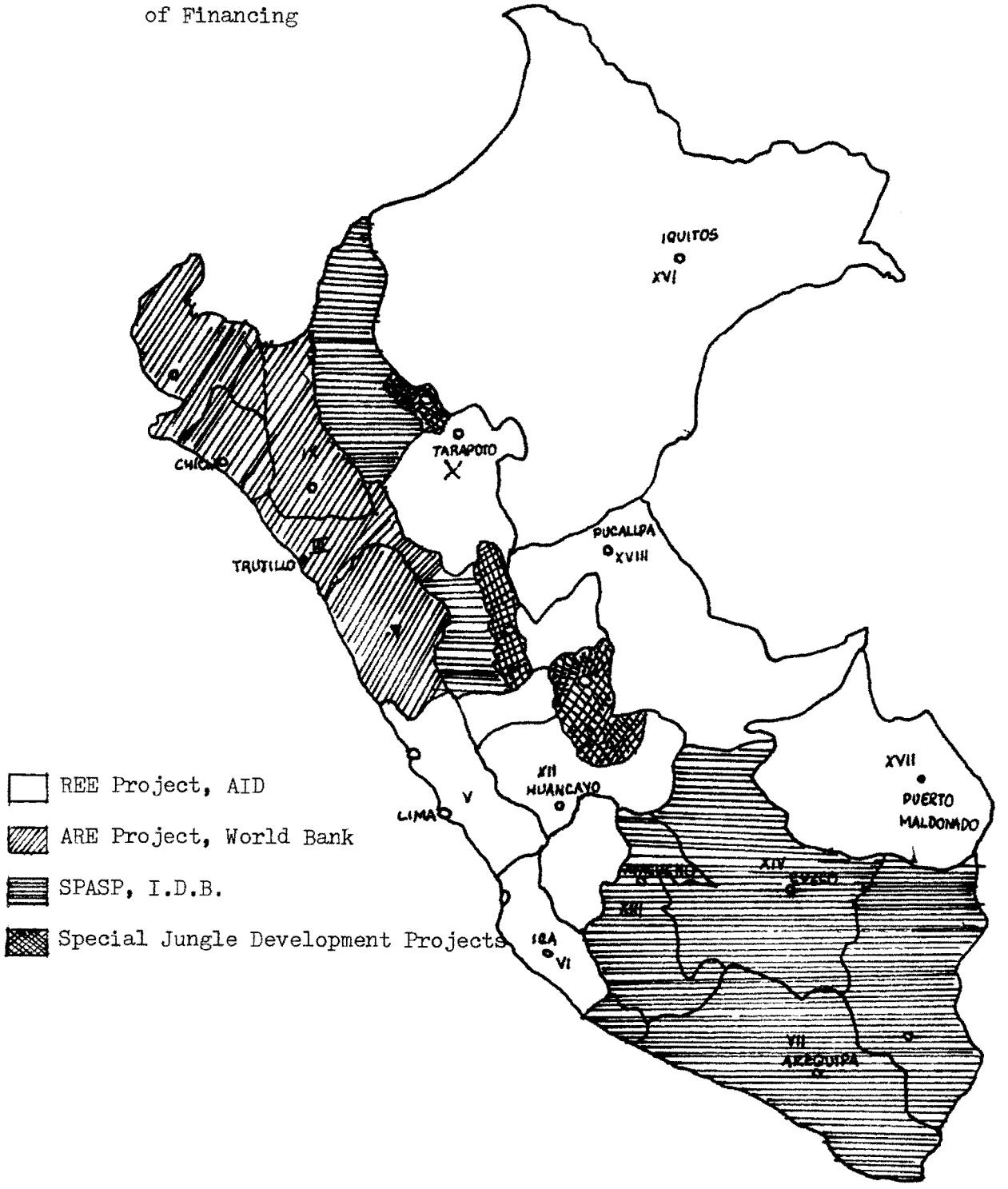
Source: Tables 34, 35, 36.

Table Nº 42 Annual Geometric Growth Rates (in %) of production area and yield, from 1980 to 1984 for selected products, by NIARP Investment Projects.

PRODUCTS	Annual Geometric Growth Rates (%)											
	ARE PROJECT - BIRF			REE PROJECT - AID			SPASP PROJECT - IDB			TOTAL		
	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield
Rice	38.09	35.92	1.59	14.21	13.55	0.58	0.87	(1.95)	2.87	26.30	22.92	2.76
Barley	1.19	0.67	0.49	(4.29)	(2.79)	(1.54)	(10.20)	(7.53)	(2.87)	(4.89)	(3.78)	(1.15)
Beans	12.56	13.55	(0.88)	1.50	(0.55)	2.06	0.29	(0.67)	0.98	5.17	6.24	(1.02)
Fava Beans							1.24	0.60	0.61	1.24	0.60	0.61
Sweet Corn	23.37	7.28	15.01	18.91	12.79	5.42	(2.37)	(3.01)	0.66	10.01	3.99	5.79
Yelow Corn	17.49	9.07	7.83	7.49	7.76	(0.25)	3.92	(1.71)	5.72	10.88	7.38	3.26
Lima Beans				13.88	0.07	13.78				13.88	0.07	13.78
Potato	8.94	8.19	0.69	1.12	0.89	0.23	(5.67)	(9.55)	4.29	(0.37)	(3.29)	3.02
Soybean	(46.85)	(36.45)	(16.37)							(46.85)	(36.45)	(16.37)
Wheat	3.76	9.86	(5.54)	(0.71)	(0.86)	0.14	(5.88)	(7.10)	(1.92)	(0.47)	3.05	(3.42)
TOTAL		13.69			6.37			(6.12)			5.07	

Source: Tables 37, 38, 39.

Map. No. 1 Geographic Division of the National REE System, by sources of Financing



yield, between 1980 and 1984 for the producers mentioned in Table No. 15, by NIARP Investment project area, also separately but differently grouped in regions, the geometric rates presented in Table. No. 15

2.2 The Norton and Gonoza Study

The Norton and Ganoza study, carried out during the first semester of 1985, is the most complete and systematic evaluation study done thus far on the cost-benefit relation of research and agricultural extension in Peru. The study was one of the components of an AID-financed project called "Evaluation of Agricultural Research and Extension in Peru". In particular, the study evaluated the net economic benefits of the National Programs for Agricultural Research and Extension carried out by the NAIRP for rice, corn, wheat potatoes and beans. The study estimated the rates of return on agricultural research and extension for the products mentioned, as well as the consequences of the distribution of benefits among consumers and producers with different levels of income, unit production sizes and regional location. In synthesis, the Norton and Ganoza study attempted to evaluate the efforts made by NIARP from 1981 in its major programs.

2.2.1 Methodology

The Norton and Ganoza atudy divided its methodological aspects into two major sections: 1) in relation to the major aspects to be considered in research and extension evaluation, and2) data-collection methods.

2.2.1.1 Major aspects considered in the evaluation of agricultural research and extension

1) The study considered that any evaluation of agricultural research

and extension activities carried out by the NAIRP should consider the following: a) generation of new technologies. An evaluation of new technologies developed or in progress thanks to NAIRP efforts can be obtained by examining , first of all,the finished projects or those in progress. The projects were examined by their relation to the National Programs, by the products included in the Programs and by their geographic location within the country. These results are available both for experimental fields and for demonstration fields. b) It was necessary to interview field researchers to obtain their estimate of the most probable changes productivity and cost resulting from specific research projects, and their estimate of the probable success of each project. The same researchers were also asked to estimate the time needed before launching the technologies presently in progress on the market.

In order to obtain this information, the study developed and applied a survey to researchers and extension agents at each ARPC, where the offices for the National Rice, Corn, Wheat, Potato and Bean Projects are located. In addition, the study collected the necessary information on the resources used for research, especially in relation to the direct costs of each National Product Program, by region and by year. Likewise, the study estimated the indirect costs and assigned them to each National Program in the same proportion as the direct costs. The value of the NAIRP's physical capital was calculated, and for the calculation of depreciation, a twenty-year depreciation period was established for general infrastructure and ten years for equipment and machinery (which means an annual depreciation rate of 5% for infrastructure and 10% for equipment and machinery).

2) Estimate of the demand for the results of research. There are two important determinants of the benefits of research: the first is the rate of adoption of the new technologies through time and the second is the rate of geographic dissemination of knowledge or technology generated by the research. In consequence, the study had to find information with respect to the availability of agricultural credit, markets for products, material, price policies, land-holding patterns, etc., all of which would be used to evaluated their influences in the adoption of research results. It was considered that benefits received to-day are worth more than benefits received later, and that the greater area covered by the benefits, the greater their effect. The adoption of research results is, in turn, affected by many factors. For example, an efficiently-functioning extension service can affect the adoption rate. The availability of agricultural credit, materials, markets for products, "attractive" product prices , education, land-holding are all variables that can affect the demand for research results by agricultural producers. Likewise, the new technologies in general require investments in modern resources such as fertilizers and pesticides, which in turn require agricultural credit and adequate price policies, all of which contributes to the adoption of research results. Producers with higher levels of education are normally better-prepared to attend, use and manage new technology. The geographic dissemination of technology depends on the relative homogeneity of the region in which they are presented to farmers, as well as on the environmental sensitivity to new methods. This means that there are some technologies whose characteristics are more specific to the area in which they are to be applied than others. Also, some technologies adjust better and

more rapidly to the production systems presently in use than others and might depend less on the size of the production unit, available water, etc. The survey was designed to obtain information from researchers and extension agents as to the adoption rate, through time, and the geographic dissemination rate of research results. The survey also collected information about the depreciation of research results in time, since technologies can depreciate as new plant or animal diseases appear, or as local insects, mircoorganisms and virus become more resistant to known control methods. Also the need for new materials or resources to be used with the new technologies was investigated and whetheher the new method had produced (or would be able to produce) an increase in area presently under cultivation and/or a substitution of crops presently cultivated. Finally, the survey asked the researchers and extension agents to estimate the dissemination rate for new technology with and without extension service.

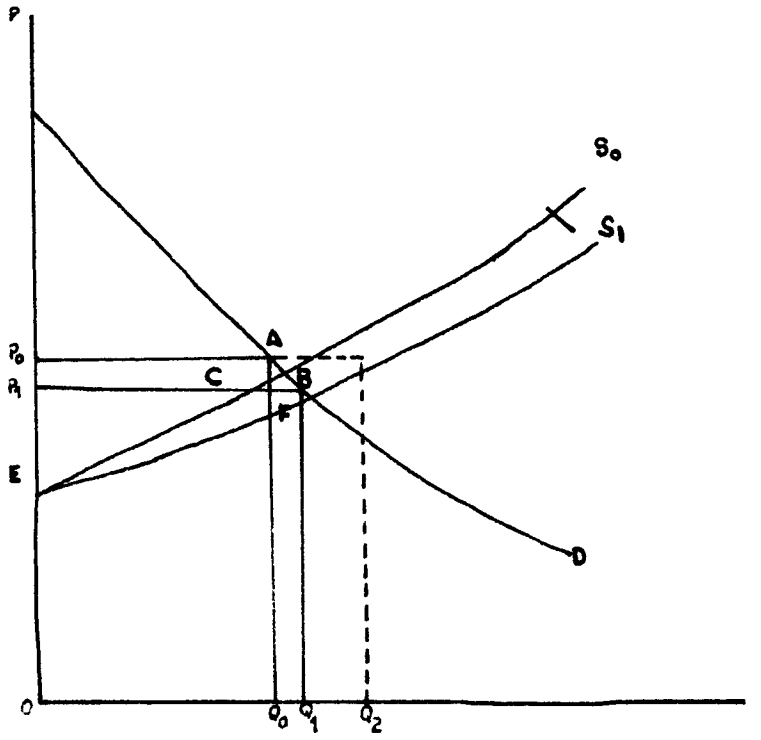
3) The "value" of research and extension. The study presents the method for determining the value of research and extension. The quantitative evaluation of research and extension benefits in Peru used by the Norton and Ganoza study used a procedure which requires the calculation of many indices, also known as the"producer and consumer excess" method. The method considers "benefit" as a criterion for improving the income or economic welfare of producers and consumers, and involves the estimation of changes in the consumer's and producer's excesses, derived from movements in the supply curve to the right when there have been or will be technological changes in Peruvian agriculture, The study made separate

analyses for rice, corn, wheat, potatoes and beans, as well as for the total of these crops. The basic procedure used for analysis is shown in Figure 2, for the case of a closed economy with no imports or exports, where the saleable excess is equal to production and it is assumed that agricultural industry is in a perfectly competitive situation. Later, this basic procedure is refined by other factors which relax the prior suppositions with respect to commerce, the saleable excess, thereby permitting changes in thedemand curve due to changes in population and income.

The first of these changes refers to the situation in which a significant of food produced is consumed right in the unit of production from which it came. In this case, the producers are the consumers and the proportion consumer in the production unit varies from one product to another. Since domestic consumption in a production unit does not easily respond to variations in the proce of the product, its demnad curve can be represented by a vertical line, as shown in figure 3. The result is that a change in the supply curve $S_0 - S_1$, given technological change, will have very little influence on domestic consumption at the production unit level. The final result is that the total net social excess is the same as for Figure 2, but now part of the benefits that the consumer received in the first case are received by the producers, in the second case.

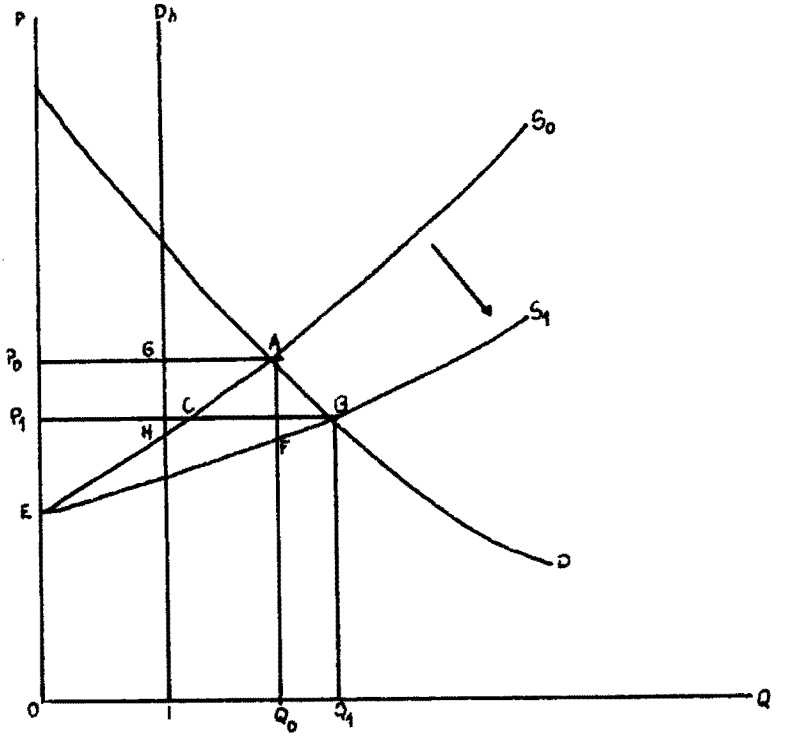
A second refinement in the basic model considers the fact that while new technologies are producing changes in the supply curve through time ,

Figure 2. Benefits of Research and Extension



D: Demand Curve
S_0: Supply curve with original technology
S_1: Supply curve with new technology
P_0: Original price
P_1: New price
Q_0: Original quantity
Q_1: New quantity
$Q_2 - Q_0$: Percent change in supply curve due to new technology

Figure 3. Benefits of Research and Extension with Domestic Consumption by Producers



D: Demand curve
S_0: Supply curve with original technology
S_1: Supply curve with original technology
P_0: Original price
P_1: Original price
Q_0: Original quantity
Q_1: New quantity
D_n: Demand curve with domestic consumption in production units

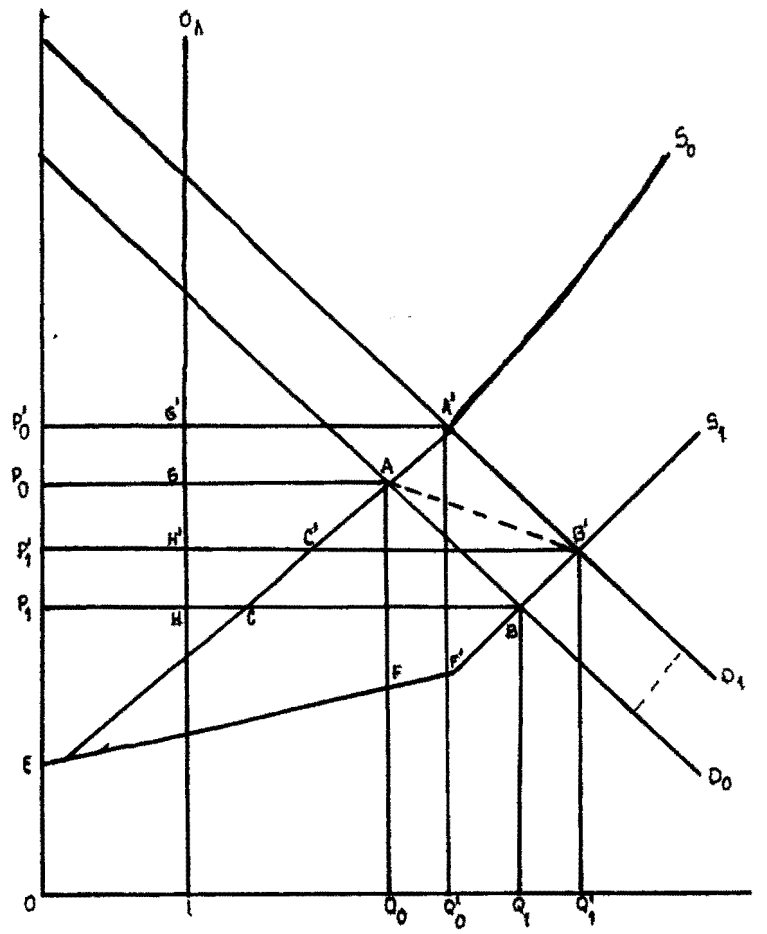
chenges in the population and income also change the demand curve. This situation is shown in Figure 4, for the case of a closed economy. The third change in the basic model considers the fact that Peru imports some of the products for which new technologies are being developed . This case, shown in Figure 5, considers the existing world price for the product being analyzed. This method was used to analyze the cases of wheat and corn, given that Peru presently imports both products and that projections indicate that these imports will continue in the future.

Finally, the model was also modified to consider the products for which the supply presently exceeds domestic demand, at the present price on the world market (see Figure 6).

The methodological instrument presented allowed for the calculation of changes in excess to the consumer, the producer and the total of the net economic benefit. After that, the present value of the benefits and the internal rates of return for research and extension activities for corn, rice, wheat,potatoes and beans, as well as for all five products together, were calculated. The internal rate of return (IRR)the value which makes the sum of discounted benefits of research and extension (R_t) minus the costs of research and extension (C_t) equal to zero, according to the following formula:

$$\sum_{t=0}^{T} \frac{R_t - C_t}{(1 + IRR)^t} = 0$$

Figure No. 4. Benefits of Research with a Change in Demand



D : Original demand curve

D_1: New demand curve after increases in population and income

S_0: Supply curve with original technology

S_1: Supply curve with new technology

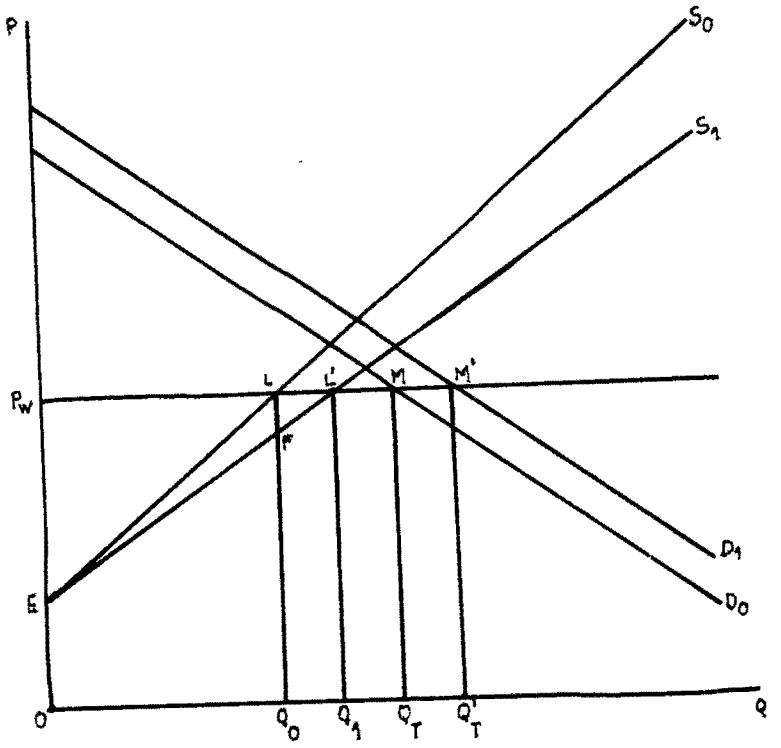
P_0: Original price

Q_0: Original quantity

P'_0 and Q'_0: Price and quantity after change in demand but no change in supply

(Translator's note: There are other illegible details given below this final line of text)

Figure No. 5 Benefits of Research and Extension under Import Conditions



D_0: Original demand curve

D_1: New demand curve after increases in population and income

S_0: Supply curve with original technology

S_1: Supply curve with new technology

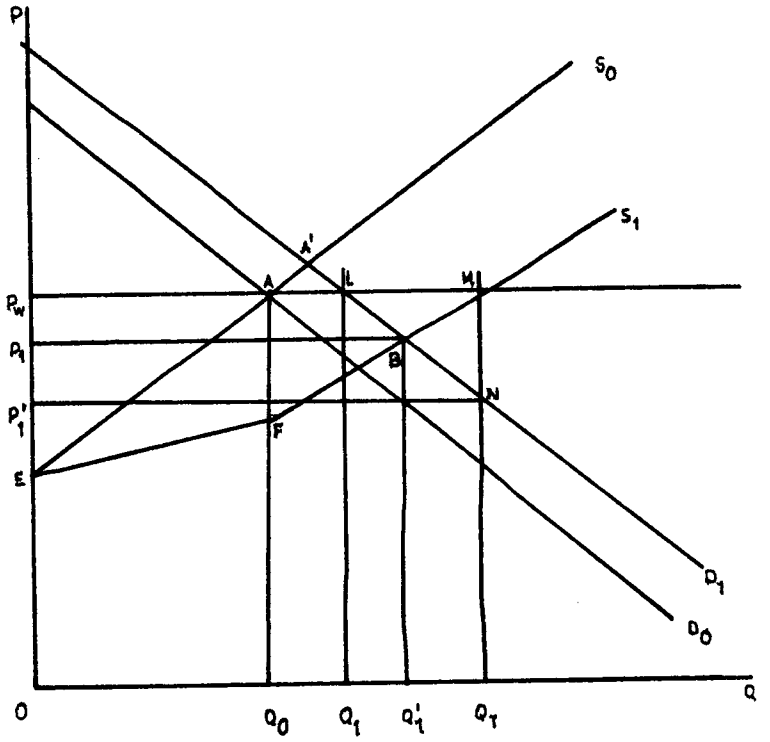
P_W: World price

Q_0: Original quantity produced domestically

Q_1: Original quantity consumed domestically

(Translator's note: There are other details illegible in the original given below this final line of text.)

Figure no. 6. Benefits of Research and Extension under Conditions of Excess Supply



D_0: Original demand curve

D_1: New demand curve after increases in population and income

S_0: Supply curve with original technology

S_1: Supply curve with new technology

P_w: World price

Q_0: Original quantity

Q_1: Domestic demand under free market conditions after a change in demand

Q_T: Domestic supply under free market conditins after a change in supply

P_1 and Q'_1: Domestic proces and quantities with limited foreign trade

P'_1: Consumer price with no exports and producer's price maintained at P_w

2.2.1.2 Data collection

In order to calculate the percent change in the supply curve due to research and extension, information was obtained in relation to projected increase in yields, rates of adoption and changes in production costs. The survey mentioned previously was developed and applied to researchers and extension agents in those ARPCs where most of the corn, rice, wheat, potatoes and beans were produced. The first draft of the questionnaire was prepared in Lima and pre-tested with technicians in research and extension in NAIRP's main office, and revised on the basis of perliminary comments. The revised version was then field-tested with 20 technicians at the ARPC VI- Ica. Based on this second trial and after making the revisions necessary, the questionnaire was applied at the ARPC II- Chiclayo, the site of the National Rice Program, ARPC I- Piura, another large rice-producing area, ARPC X- Moyobamba, site of the National Corn Program and branch office for the National Rice Program, ARPC XII- Huancayo, site of the National Potato Program, and at ARPC VI- Ica, site of the National Granular Legumes Program. In addition, the questionnaire was also applied at the ARPC XIV - Cusco, site of the National Cereals Program and ARPC VIII- Tacna. A total of 45 answers were received for research cases and 40 for extension cases.

Additional information was obtained through several sources already published with respect to quantities produced nationally and regionally, prices, area cultivated, imports and exports for each crop, as well as the proportion in which each product in consumed within the production unit. Data on investments (costs) in research, extension and administra-

tion were found at the central office of the NAIRP.

Both the information directly collected by the application of the survey questionnaire, as well as the information obtained from secondary sources, is presented in Tables 43 to 67.

Recent estimates of the price elasticity in demand or of the income elasticity in the demand for selected products were unobtainable; therefore, information published by Amat and Leon and Cournisy, based principally on the National Survey of Food Consumption (NSFC), made in 1972, which calculated elasticity in costs, and from them, income elasticity and price elasticity of the demand for each product. The procedure for calculating price elasticity was based on the following relation, derived from consumer theory:

$$e_i = E_i \, (A_i - (1-A_i E_i)/ W)$$

which was developed by Frisch. The variable e is the price elasticity for product demand i; the variable A_i is the proportion of consumer budget spent on product i. The variable W is money flexibility, which is equal to $\frac{du}{da} \cdot \frac{a}{u}$, when U is the marginal profit on monet and a is monetary income. It is assumed that the marginal profit of each good in independent of the quantity consumed of any other good. Since the flexibility coefficient of money increases as the level of income decreases, and since other studies in Latin America had obtained values between 3 and 1 for this coefficient, the Norton and Ganoza study assumed that $w = 2$,

Table No. 43 Research cost and Number of Reserchers for 1970 - 1980

YEAR	RESEARCH COSTS THOUSANDS OF DOLLARS (CONSTANT - 1975)	NUMBER OF RESERCHERS
1970	6,317	171
1971	6,649	180
1972	7,092	192
1973	7,572	205
1974	7,303	220
1975	10,189	253
1976	9,980	248
1977	4,491	264
1978	3,211	240
1979	4,664	259
1980	5,821	296

Source.- Oram, P. A. and V. Bindmish. "Resource Allocation to National Agricultural Research: Trends in the 1970's", ISNAR, The Haque and IFPRI, Washington, November, 1981. Cited by Norton y Ganoza (1985)

Table 44; Imports and Exports of rice, corn, Wheat, potatoes, beans and for Total of Crops Mentioned (metric tons)

YEAR	RICE	YELLOW CORN	SWEET CORN	WHEAT
1979	(150423)(1)	(127511)(1)	2430	(898665)(1)
1980	(225816)	(485393)	2870	(823747)
1981	(136782)	(359028)	1614	(941732)
1982	(56847)	(480737)	1654	(934771)
1983	(95352)	(425021)	1119	(966888)

YEAR	POTATOES	BEANS	TOTAL
1979	---	---	(1174169) (1)
1980	---	---	(1532086)
1981	---	---	(1445928)
1982	---	---	(1470671)
1983	---	---	(1486242)

(1) Imports in parenthesis.

Source: Ministry of Agriculture, Basic Statistical Information for the Agricultural Sector to 1985, Sectoral Statistics Office, Lima, April, 1985.

Table No 45: Imports and Exports of rice, corn, wheat, potatoes, beans, and for Total of Crops Mentioned (metric tons)

YEAR	RICE	YELLOW CORN	SWEET CORN	WHEAT
1979	(13059)	(4034)(1)	490	(37375)(1)
1980	(29590)	(23328)	715	(48888)
1981	(33092)	(24811)	713	(84856)
1982	(14266)	(46700)	1091	(127997)
1983	(64356)	(113493)	1595	(295603)

YEAR	POTATOES	BEANS	TOTAL
1979	---	---	(54468)(1)
1980	---	---	(101808)
1981	---	---	(142760)
1982	---	---	(188963)
1983	---	---	(473953)

(1) Imports in parenthesis.

Source: Minietry of Agriculture, Sectoral Statistics Office, Peruvian Central Reserve Bank (Quarterly Bulletin, No 1, 1985)

Table 46. Summary of NIARP Investments, by Activities, 1981-1985 (in thousands of current soles)

Year	ACTIVITIES				Total
	Administration	Research	Extension	Promotion	
1981	1.505.119	4.455.087	2.707.321		8.667.527
1982	4.356.446	5.416.064	10.220.054		19.992.564
1983	7.536.858	10.970.610	14.577.639	19.345.215	52.436.522
1984	34..22.865	27.707.060	30.826.908	13.292.757	105.948.790
1985	31.642.190	25.014.000	42.486.900	13.516.110	112.659.200

Source: NIARP Accounting Office (cited by Norton and Ganoza 1985)

Table 47. Summary of NIARP Investments, by Activities, 1981 - 1985 (Thousand of soles, constant to 1984)

Year	ACTIVITIES				Total
	Administration	Research	Extension	Promotion	
1981	10.987.368	32.522.136	19.763.443		83.272.647
1982	19.933.907	24.036.492	45.356.600		88.726.999
1983	15.842.475	23.060.643	30.642.197	40.663.642	110.208.967
1984	34.122.065	27.707.06o	30.826.908	13.292.757	106.948.790
1985	23.092.798	18.260.220	31.015.438	9.866.760	82.241.216

1/

Source: NIARP Accounting Office (cited by Norton and Ganoza 1985)

1/ To July, at 1984 prices

Table 48. Summary of NIARP Investments, 1981-85 (in millions of current soles and in millions of constant soles, 1984)

YEAR	TOTAL	TOTAL MINUS CAPITAL EXPENSES	DEPRECIATION (1)
1981	8668	8037	1552
1982	19993	19708	1981
1983	52431	46119	3661
1984	105949	96375	5929
1985	112659	98585	7904

YEAR	TOTAL MINUS CAPITAL EXPENSES PLUS DEPRECIATION	
	CURRENT SOLES	1984 SOLES
1981	9589	69996
1982	21684	96239
1983	49780	104645
1984	102304	102304
1985 (2)	106489	106489

(1) Calculated at 5% of the value ofphysical infraestructure and at 10% of the value of equipment.

(2) Programmed in average 1984 soles.

Source: Table No. 46 and Norton and Ganoza (1985)

TABLE No. 49 Investments in research and Extension by National Programs (in millions of 1984 soles)

	RICE		CORN		WHEAT		POTATOES		BEANS		TOTAL	
YEAR	RES.	EXT.	RES.	EXT.	RES.	EXT.	RES.	EXT.	RES.	EXT.	RES.	EXT.
1,980	3,666	2,830										
1,981	2,798		2,655	2,671					1,045			
1,982									803			
1,983									1,078			
1,984									943			
1,985			2,007	7,437	2,007	3,166	2,401	14,210	789	1,767	9,967	34,459
1,986			2,007	7,437	2,007	3,166	2,401	14,210	789	1,767	9,967	34,459
1,987	0		0	7,437	0	3,166	0	14,210	0	1,767	0	34,459
1,988	0		0	7,437	0	3,166	0	14,210	0	1,767	0	34,459
1,989	0		0	7,437	0	3,166	0	14,210	0	1,767	0	34,459
1,990	0		0	7,437	0	3,166	0	14,210	0	1,767	0	34,459

1. Preliminary information
2. Projected values for research and extension
3. Projected values for extension

Source: Basic Documents for National Product Program, cited by Norton and Ganoza (1985)

(Translator's note: The data not included in this table were illegible in the text provided.)

Table 50 Quantities produced of rice, corn, Wheat, potatoes and totals from 1979 - 1984 (metric tons)

YEAR	RICE	CORN	WHEAT	POTATO	BEANS	NATIONAL TOTAL
1979	560399	621457	102060	1695116	47693	3026725
1980	420371	452656	77142	1379648	39342	2369159
1981	712086	586756	118551	1678600	43562	3139561
1982	775529	631263	166867	1799640	43320	3350628
1983	790802	594849	75056	1152864	36781	3650352
1984	1133819	782955	88179	1462390	48403	3515946

Sources: 1. Maletta, H., et al. Perú. El Agro en Cifras Pacific and Agrarian Bank of Perú, 1984

2. Sectorial Statistics Office, Ministry of Agriculture, Cited by Norton and Garoza (1985)

Table No. 51. Prices of rice, corn, Wheat, potatoes and beans received by Farmers in current and constant soles (soles/kg).

YEAR	RICE	CORN	WHEAT
1979	50.54 (1029.36)	39.97 (814.15)	47.47 (966.90)
1980	74.65 (955)	57.27 ( )	61.80 (791.)
1981	122.00 (890.51)	82.70 (603.65)	109.10 (789.05)
1982	184.94 (820.86)	126.19 (540.08)	132.69 (588.94)
1983	321.58 (675.91)	(491.54)	342.23 (719.43)
1984	820.00 (598.91)	(558.76)	(1679.94)

YEAR	POTATOES	BEANS	TOTAL
1979	11.85 (687.41)	85.81 (1748.11)	10.48 (804.01)
1980	62.05 (794.49)	(2022.41)	64.28 (823.09)
1981	66.70 (486.86)	299.10 (2183.21)	87.02 ( )
1982	84.67 (375.81)	338.51 (1502.50)	120.43 ( )
1983	299.70 (630.01)	(1520.81)	298.51 ( )
1984	580.00 (423.64)	3487.00 (2546.93)	612.60 (447.45)

Note: The numbers in parenthesis are average prices in 1984 soles.

Source: Agricultural Statistics, 1983, OSE Ministry of Agriculture, cited by Norton and Garoza (1985)

(Translator's Note: The spaces left blank have figures that are illegible in the photocopy provided.)

TABLE No. 52 Percent change in demand for rice, corn, wheat, potatoes, and beans, by year at constant prices

YEAR	(1) PERCENT CHANGE IN POPULATION	(2) PERCENT CHANGE IN PER-CAPITA INCOME	ELASTICITY - DEMAND INCOME (3) RICE	CORN	WHEAT	POTATOES	BEANS	TOTAL	CHANGE IN DEMAND RICE	CORN	WHEAT	POTATOES	BEANS	TOTAL
1,981	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,982	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,983	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,984	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,985	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,986	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,987	2.80	1	.76	.48	.48	.64	.61	.76	3.6	3.3	3.3	3.4	3.4	3.6
1,988	2.70	1	.76	.48	.48	.64	.61	.76	3.5	3.2	3.2	3.3	3.3	3.5
1,989	2.70	1	.76	.48	.48	.64	.61	.76	3.5	3.2	3.2	3.3	3.3	3.5
1,990	2.70	1	.76	.48	.48	.64	.61	.76	3.5	3.2	3.2	3.3	3.3	3.5
1,991	2.70	1	.76	.48	.48	.64	.61	.76	3.5	3.2	3.2	3.3	3.3	3.5
1,992	2.70	1	.76	.48	.48	.64	.61	.76	3.5	3.2	3.2	3.3	3.3	3.5
1,993	2.60	1	.76	.48	.48	.64	.61	.76	3.4	3.1	3.1	3.2	3.2	3.4
1,994	2.60	1	.76	.48	.48	.64	.61	.76	3.4	3.1	3.1	3.2	3.2	3.4
1,995	2.60	1	.76	.48	.48	.64	.61	.76	3.4	3.1	3.1	3.2	3.2	3.4
1,996	2.60	1	.76	.48	.48	.64	.61	.76	3.4	3.1	3.1	3.2	3.2	3.4
1,997	2.60	1	.76	.48	.48	.64	.61	.76	3.3	3.0	3.0	3.1	3.1	3.3
1,998	2.60	1	.76	.48	.48	.64	.61	.76	3.3	3.0	3.0	3.1	3.1	3.3
1,999	2.60	1	.76	.48	.48	.64	.61	.76	3.2	2.9	2.9	3.0	3.0	3.2
2,000	2.60	1	.76	.48	.48	.64	.61	.76	3.2	2.9	2.9	3.0	3.0	3.2

Sept. 17-4 p. 83

1. Interpolation in projections for 1984, 1990, 1995 and 2000 by Ministry of Agriculture, Situación del Agro Peruano, September, 1984, pp. 33
2. Projection
3. Based on expense elasticity calculated by Amat and Leon and D. Gurowiey, La Alimentación en el Peru, Pacific University, 1982

Source: Norton and Ganoza (1985)

Pacific U, 1981

Table No. 53 Cost Elasticity for Products from NIARP National Programs.

	URBAN	RURAL	TOTAL
RICE	0.61	1.12	0.76
CORN (2)	0.40	0.67	0.48
WHEAT (2)	0.40	0.67	0.48
POTATO	0.49	1.00	0.64
BEANS	0.48	0.91	0.61
TOTAL	0.71	0.87	0.76

(1) Weighted average for Lima, regional capitals and other urban areas.

(2) The cost elasticity data available for cereals was used, since data was unavailable for corn and Wheat

Table No. 54. Summary of Researchers' Responses to Questionnaire.

	RICE	CORN	POTATOES	BEANS	WHEAT
Number of Responses	15	9	4	8	9
Type of Research:					
Varieties	9	9	3	3	6
Cultivation Practices	12	9	4	4	8
Phytosanitary Control Measures	7	6	1	5	4
Expected average value of percent increase in yields	26	168	144	96	110
Expected average value of percent increase in cost/hectare	10	153	35	89	63
No. of varieties degenerated.	5	3	3	4	11

Source: Norton and Ganoza (1985)

Table 55 Summary of Responses of Extension Workers to Questionnaire.

	RICE	CORN	POTATOES	BEANS	WHEAT
Number of Responses	18	9	7	5	1
Expected average value of percent increase in yields.	15	56	125	94	28
Expected average value of percent increase in cost/hectare	15	45.5	55.5	39	--
If the risk is higher, are the farmers expected to assume it?		Yes = 33			No = 5
Percent adoption of new technology (expected)					
Year 1	17	12	5(1)	7	5(1)
Year 2	25	19	8	10	8
Year 3	37	26	12	14	10
Year 4	46	36	16	19	12
Year 5	56	50	25	30	15

Source - Norton and Ganoza

(1) Several interviewees did not reply for potatoes and wheat. These are the estimates given by NIARP technicians in the central office.

Table 56. Expected percent values in Area Under Cultivation with new technologies.

YEAR	RICE	CORN	WHEAT	POTATOES	BEANS
1981	0	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
1984	17	0	0	0	0
1985	25	12	0	5	0
1986	37	19	5	8	0
1987	46	26	8	10	7
1988	56	50	12	12	10
1989	56	50	16	15	14
1990	56	50	25	15	19
1991	56	50	30	15	30
1992	56	50	30	15	30
1993	56	50	30	15	30
1994	56	50	30	15	30
1995	56	50	30	15	30
1996	56	50	30	15	30
1997	56	50	30	15	30
1998	56	50	30	15	30
1999	56	50	30	15	30
2000	56	50	30	15	30

Source: Norton and Ganoza (1985)

Table No 57 Summary of Estimated Projections by Researcher and Extension Agents with respect to yields and Producers' costs in Adoption of New Technologies.

	Expected Percent Change in Yields			Expected Percent Change in Yields		
	Researcher	Extension Agent.	Average	Researcher	Extension Agent	Average
Rice	26	15	20.5	10	15.0	12.5
Corn	168	55	111.5	153	46.5	99.3
Potatoes	144	125	134.5	35	55.5	45.3
Beans	96	94	95.0	89	39.0	64.0
Wheat	110	--	110.0	63	--	63.0

Percent Change in Supply area and prices constant
(Supply elasticity = 1)

Rice	8
Corn	12
Potatoes	89
Beans	31
Wheat	37

Source - Norton and Ganoza (1985)

Table No. 58. Accumulated Percent Change in Supply prices and area cultivated.

YEAR	RICE	CORN	WHEAT	POTATOES	BEANS	TOTAL
1984	1	0	0	0	0	.262
1985	2	1	0	4	0	2.69
1986	3	2	2	7	0	4.69
1987	4	3	6	9	2	6.28
1988	5	4	8	11	3	7.80
1989	5	6	12	13	4	9.33
1990	5	6	14	13	6	9.41
1991	5	6	14	13	9	9.46
1992	4	6	14	13	9	9.19
1993	4	5	14	12	9	8.50
1994	3	5	13	12	9	8.21
1995	3	4	13	11	8	7.50
1996	2	4	12	11	8	7.21
1997	2	3	12	10	7	6.50
1998	1	3	11	10	7	6.21
1999	1	2	11	9	6	5.50
2000	0	2	10	9	6	5.21

Source: Norton and Ganoza (1985)

Table No. 59 Comparision of yields and costs between present and improved technologies in test fields, developed by the technology transfer an Improved Seed Project (TTISP), 1980-1985.

	Present Technology	Improved Technology	Percent Change
Rice			
Yield (Kg/Hectare)	4951	6119	24
Costs (I/Hectare)	121	136	12
Corn			
Yield (Kg/Hectare)	2416	3694	53
Costs (I/Hectare)	56	80	43
Wheat			
Yield (Kg/Hectare)	N.A.	N.A.	--
Costs (I/Hectare)			
Potatoes			
Yield (Kg/Hectare)	9993	18584	86
Costs (I/Hectare)	63	222	36
Beans			
Yield (Kg/Hectare)	1005	1233	23
Costs (I/Hectare)	53	72	36

Source - Computerized summaries of TTISP results provided by the National Agroeconomic Program. Cited by Norton and Ganoza.

1/ Cost in Intis/Hectare (1 Inti = 1,000 soles)

Table No. 60 Supply price elasticity calculated for different values of the monney flexibility coefficient (Ø)

	URBAN			RURAL			TOTAL		
	Ø=1	Ø=2	Ø=3	Ø=1	Ø=2	Ø=3	Ø=1	Ø=2	Ø=3
Rice	-.61	-.31	-.22	-1.11	-.57	-.39	-.76	-.89	-.27
Corn	-.41	-.21	-.15	-0.70	-.39	-.28	-.50	-.26	-.19
Wheat	-.41	-.21	-.15	-0.70	-.39	-.28	-.50	-.26	-.19
Potatoes	-.49	-.25	-.17	-1.00	-.54	-.39	-.64	-.34	-.24
Beans	-.48	-.25	-.16	-0.91	-.46	-.31	-.61	-.31	-.21
Total	-.80	-.58	-.50	-0.94	-.76	-.70	-.84	-.63	-.56

Source - Norton and Ganoza (1985)

1. Weighted average for Lima, regional capitals and other urban areas

2. Due to lack of data for elasticity for corn and wheat, total elasticity for cereals was used.

TABLE No. 61 Net benefits of NIARP research and extension, with parallel change in supply (1)

YEAR	RICE		CORN	WHEAT	POTATOES		BEANS	TOTAL
	Free Market	No Market	Free Market	Free Market	No Change in Demand	With Change in Demand	No Market	
1,981	(6,486)	(6,486)	(5,326)	(3,792)	(8,282)	(8,282)	(1,680)	(25,566)
1,982	(9,535)	(9,535)	(8,392)	(4,740)	(14,585)	(14,585)	(2,311)	(39,563)
1,983	(9,838)	(9,838)	(8,464)	(5,177)	(14,219)	(14,219)	(2,438)	(40,136)
1,984	(6,922)	(6,663)	(8,757)	(5,111)	(15,133)	(15,133)	(2,457)	(38,380)
1,985	(4,211)	(3,574)	(7,650)	(5,173)	(2,038)	2,166	(2,556)	(21,629)
1,986	(610)	391	(5,749)	(4,253)	8,174	16,985	(2,556)	(4,994)
1,987	6,167	7,361	(1,672)	(125)	16,346	29,363	(547)	20,170
1,988	10,733	11,735	634	1,296	21,202	38,837	131	33,997
1,989	11,664	12,262	5,643	4,608	25,020	47,521	843	47,778
1,990	12,641	12,802	6,428	7,358	22,383	46,277	2,234	51,043
1,991	21,545	21,235	14,697	11,997	34,133	59,269	6,042	86,413
1,992	17,754	17,476	15,579	13,677	31,838	58,074	6,041	84,889
1,993	18,465	18,004	13,503	15,591	27,504	52,624	6,031	81,094
1,994	14,127	13,936	14,178	16,216	25,803	51,787	6,020	76,345
1,995	14,551	14,422	11,684	18,325	22,262	46,867	5,361	72,183
1,996	9,798	9,968	12,151	18,777	21,005	46,385	5,384	67,116
1,997	9,994	10,349	9,297	21,030	18,074	41,805	4,740	63,135
1,998	4,998	5,381	9,575	21,207	17,150	41,547	4,780	57,710
1,999	5,048	5,604	6,448	23,540	14,691	37,223	4,139	53,866
2,000	0	0	6,577	23,328	14,017	37,145	4,192	48,114
IRR 2/	0.17	0.18	0.10	0.19	0.22	0.34	0.14	0.17
PRESENT VALUE NET	70,731	23,120	992	26,088	58,183	158,335	3,950	109,942

1. The net economic benefits were calculated as the total change in the economic surplus, minus total investments in research and extension (in millions of soles - constant for 1984)

Source: Norton and Banoza (1985)

TABLE No. 62 Net economic benefits of NIARF research and extension, using high and low estimates of price elasticity in demand. (1)

YEAR	RICE		POTATOES		BEANS		TOTAL	
	n=-.76	n=-.27	n=-.64	n=-.24	n=-.61	n=-.21	n=-.84	n=-.56
1,981	(6,486)	(6,486)	(9,282)	(9,282)	(1,680)	(1,680)	(25,566)	(25,566)
1,982	(9,535)	(9,535)	(14,585)	(14,585)	(2,311)	(2,311)	(3,953)	(3,953)
1,983	(9,838)	(9,838)	(14,219)	(14,219)	(2,438)	(2,438)	(40,136)	(40,136)
1,984	(6,718)	(6,638)	(15,133)	(15,133)	(2,457)	(2,457)	(38,380)	(38,380)
1,985	(3,710)	(3,512)	(1,797)	(2,144)	(2,556)	(2,556)	(21,388)	(21,734)
1,986	179	487	9,178	7,741	(2,556)	(2,556)	(3,939)	(5,427)
1,987	7,114	7,470	18,475	15,446	(615)	(515)	22,230	19,301
1,988	11,544	11,818	24,952	19,652	26	179	37,641	32,495
1,989	12,165	12,300	30,900	22,654	707	905	58,522	45,473
1,990	12,806	12,793	29,432	19,619	2,067	2,309	57,926	48,355
1,991	21,345	21,177	42,221	31,045	5,913	6,097	96,373	85,381
1,992	17,576	17,425	40,846	28,489	6,013	6,050	93,869	81,549
1,993	18,147	17,932	36,446	24,259	6,107	5,993	90,112	77,811
1,994	14,014	13,894	35,361	22,420	6,202	5,937	86,084	72,878
1,995	14,491	14,384	31,421	19,091	5,594	5,256	81,574	68,906
1,996	9,962	9,966	30,571	17,768	5,698	5,245	76,996	63,739
1,997	10,305	10,363	27,015	15,109	5,068	4,596	72,404	60,026
1,998	5,315	5,408	26,357	14,159	5,170	4,611	67,308	54,450
1,999	5,500	5,648	23,120	17,001	4,511	3,980	62,667	51,017
2,000	0	0	22,619	11,324	4,610	4,014	57,134	45,243
IRR 3/	0.18	0.18	0.26	0.20	0.14	0.13	0.19	0.17
PRESENT VALUE NET	22,733	23,273	88,120	47,210	4,142	3,866	140,072	98,887

1. Net benefits calculated with the total change in economic surplus minus total costs of research and extension. (in millions of soles - constant 1984)
2. Price-elasticity in demand
3. IRR = Internal rate of return
4. Calculated at real discount rate of 10%

Source: Mexter and Scobie (1985)

TABLE No. 63 Net benefits of NIARF research and extension, with parallel change in supply (1)

YEAR	RICE		CORN	WHEAT	POTATOE	BEANS	TOTAL
	Free Market	No Market					
1,981	(6,486)	(6,486)	(5,326)	(3,792)	(8,282)	(1,680)	(25,566)
1,982	(9,535)	(9,535)	(8,392)	(4,740)	(14,585)	(2,311)	(39,563)
1,983	(9,838)	(9,838)	(8,464)	(5,177)	(14,219)	(2,438)	(40,136)
1,984	(3,832)	(3,293)	(8,757)	(5,111)	(15,133)	(2,457)	(34,751)
1,985	2,092	3,454	(5,875)	(5,173)	12,382	(2,556)	2,232
1,986	9,129	11,331	(2,126)	(3,350)	32,516	(2,556)	35,814
1,987	19,671	22,430	3,925	7,744	46,208	(668)	75,975
1,988	28,458	31,077	8,395	5,427	55,639	2,016	102,555
1,989	30,275	32,122	17,983	11,549	62,981	3,428	128,064
1,990	32,182	33,195	19,509	16,589	57,792	6,178	133,264
1,991	42,063	42,175	28,562	22,521	67,161	11,958	172,378
1,992	34,826	34,759	30,276	25,674	62,646	11,955	165,310
1,993	36,219	35,808	26,363	29,268	54,184	11,935	157,558
1,994	27,842	27,775	27,681	30,567	50,834	11,915	148,752
1,995	28,677	28,725	22,918	34,541	43,911	10,623	140,718
1,996	19,405	19,881	23,835	35,542	41,431	10,667	131,357
1,997	19,793	20,640	18,322	39,807	35,962	9,402	123,866
1,998	9,946	10,747	18,872	40,313	33,868	9,482	113,282
1,999	10,045	11,192	12,770	44,747	29,047	8,221	105,977
2,000	0	0	13,025	44,535	27,715	8,326	93,601
IRR 2/	0.35	0.37	0.22	0.28	0.42	0.24	0.33
PRESENT VALUE NET	93,382	100,141	100,141	73,053	198,233	20,750	440,590

1. Net benefits calculated with the total change in economic surplus minus total costs of research and extension. (in millions of soles - constant 1984)
2. IRR = Internal rate of return
3. Calculated at real discount rate of 10%

Source: Norton and Ganoza (1985)

TABLE No. 64 Economy in foreign currency resulting from NIAPT research and extension (in millions of soles - 1984)

YEAR	Pivoting Change in Supply			Parallel Change in Supply		
	RICE	CORN	WHEAT	RICE	CORN	WHEAT
1,981	0	0	0	0	0	0
1,982	0	0	0	0	0	0
1,983	0	0	0	0	0	0
1,984	6,119	0	0	6,119	0	0
1,985	12,360	3,516	0	12,360	3,516	0
1,986	18,911	7,103	1,769	18,911	7,103	1,769
1,987	25,970	10,868	5,413	25,970	10,868	5,413
1,988	33,762	14,925	7,651	33,762	14,925	7,651
1,989	35,450	23,283	12,394	35,450	23,283	12,394
1,990	37,222	24,680	16,195	37,222	24,680	16,195
1,991	39,083	26,161	18,462	39,083	26,161	18,462
1,992	32,630	27,730	21,047	32,630	27,730	21,047
1,993	34,143	24,495	23,994	34,143	24,495	23,994
1,994	26,632	25,720	25,399	26,632	25,720	25,399
1,995	27,431	21,604	28,701	27,431	21,604	28,701
1,996	18,836	22,469	29,937	18,836	22,469	29,937
1,997	19,212	17,526	33,530	19,212	17,526	33,530
1,998	9,798	18,052	34,424	9,798	18,052	34,424
1,999	9,896	12,395	38,211	9,896	12,395	38,211
2,000	0	12,643	38,558	0	12,643	39,558

Note: The adoption of new technologies can cause an increase in demand for materials from imported sources, such that the expenses in foreign currency (as in the case of rice) or savings in foreign currency (as in the case of wheat and corn) might be less than the projections indicated.

Source: Norton and Garcia (1985)

Table No. 65. Economic Benefits of NIARP Research and Extension, assuming that extension costs begin with presentation of new technologies.

	Internal Rate of Return (IRR)	Present Net Value 1/
Rice (free market)		
Pivoting change in supply	.22	28871
Parallel change in supply	.45	101524
Corn		
Pivoting change in supply	.16	12976
Parallel change in supply	.32	60399
Wheat		
Pivoting change in supply	.24	33037
Parallel change in supply	.34	80002
Potatoes (no change in demand)		
Pivoting change in supply	.38	81087
Parallel change in supply	.71	221137
Beans		
Pivoting change in supply	.22	8925
Parallel change in supply	.34	25725
Total		
Pivoting change in supply	.26	164896
Parallel change in supply	.47	488787

Source - Norton and Ganoza (1985)
1/ In millions of 1984 soles and real discount rate of 10%

Table No. 66 Net Economic Benefits from NIARP Research and Extension with research costs projected to 1992 and extension costs to 1996.

	Internal Rate Of Return (IRR)	Present Net Value
Rice (free market)		
Pivoting change in supply	.30	182074
Parallel change in supply	.44	414637
Corn		
Pivoting change in supply	.20	69305
Parallel change in supply	.31	191608
Wheat		
Pivoting change in supply	.28	144372
Parallel change in supply	.36	286885
Potatoes		
Pivoting change in supply	.22	60329
Parallel change in supply	.42	229166
Beans		
Pivoting change in supply	,14	4635
Parallel change in supply	.24	26717
Total		
Pivoting change in supply	.25	460711
Parallel change in supply	.38	1126929

Source - Norton and Ganoza (1985)

Table No. 67 Summary of Internal Rates of Return for NAIRP Research and Extension Activities.

	RICE	CORN	WHEAT	POTA-TOES	BEANS	TOTAL
Investment in Research, 1981 to 1986 and extension, 1981 to 1990.						
Free Market						
Pivoting Change in Supply	.17	.10	.18			.17
Parallel Change in Supply	.35	.23	.28			.33
No Market						
Pivoting Change in Supply	.18			.22	.14	
Parallel Change in Supply	.37			.42	.24	
Free Market						
Pivoting Change in Supply	.30	.20	.28			.25
Parallel Change in Supply	.44	.31	.36			.38
No Market						
Pivoting Change in Supply				.22	.14	
Parallel Change in Supply				.42	.24	

Table No. 67 cont'd

Source: Norton and Ganoza.

1/ Assumes no expansion in area under cultivation and places all costs in extension, even before new technologies are launched

2/ When a 1% growth of area under cultivation was assumed, the rates double. For example, the return on research and extension in rice and investments in extension from 1981 to 1990, changed from .17 to .48.

derived the demand elasticity and then obtained its respective range, assuming alternative values for w = 1 and w = 3. The spending elasticity estimated by Amat and Leon and Curonisy for the total population were also used in this study, but the rural and urban elasticity estimates were weighted, taking into consideration the most recent distribution of rural and urban populations in Peru.

2.2.2 Main conclusions

The Norton and Ganoza study reached the following conclusions:

1) In the decade of the seventies, food production in Peru was maintained practically constant, while the population continued to grow at an annual rate of 2.8%. During the same period, the spending for agricultural research and extension decreased.

2) Since 1980, under the auspices of the NAIRP, the National Research, Extension and Promotion Programs were established for rice, wheat, corn, potatoes and beans. The study evaluated the actual and projected economic benefits with relation to the costs of research and extension, and the possible consequences of the distribution of the benefits of the National Programs.

3) The internal rates of return on agricultural research and extension, using the most conservative assumptions, were the following: 17% for rice, 10% for corn, 18% for wheat, 22% for potatoes, 14% for beans and 17% for the total five products. Under less conservative assumptions, the rates of return were: 35% for rice, 23% for corn, 28% for wheat, 42% for potatoes, 24% for beans and 33% for the total of the five products. These rates of return are compatible with those found by evaluation studies previously carried out in other countries.

4) By deriving the rates of return, several conservative assumptions were included in the analysis, even in the case of the highest returns mentioned in the third conclusion. Therefore, these rates of return are probably representative of minimum estimates. For example, no expansion was assumed for the area under cultivation for rice, although it is quite possible that rice cultivation in the jungle region would completely compensate the eventual reductions in the coastal rice regions in the course of time. Therefore, the rate of return on investment in extension and research programs in rice may be underestimated. Another example is offered by an alternative analysis made by the study; assuming a yearly 1% increase in the area under cultivation for rice and considering that this area would be totally cultivated following the recommendations of the new technologies, the rate of return of research and extension would go from 17% to 48%. In addition, in its initial design,the study had charged all the costs of agricultural extension to the National Programs even before the new technologies were launched to the general public. But when this assumption was relaxed, although all the other assumptions were maintained in their original conservative positions, the rates of return on research and extension were much higher; in this case, the return on rice was 22%, corn 16%, wheat 24%, potatoes 38%, beans 22% and total 26%.

5) The previous conclusion also illustrates a very important point: extension without research decreases the benefits. Studies prevously carried out have shown that on the average, farmers operate efficiently, using available resources well. This conclusion is also probably true, even in the case of the highlands. The problem is that traditional technologies do not allow farmers to be very productive. The dissemination of

new knowledge and generated technologies by research increases agricultural productivity (the product/resource relation) and in some cases, also permits the expansion of agriculture into new areas.

6) The differences found in the rates of return are due to several factors. For example, in the case of corn, it was projected that its yield would grow quickly, but, with this growth, the costs of production would also increase. The increases in bean productivity are produced later than those of other crops and affect a smaller number of hectares. In the case of potatoes, both researchers and extension agents coincided in projecting strong increases in yield. The yields of rice and its projected production costs were assumed to be low, but the increases achieved will affect a great number of hectares. The increases in wheat productivity will affect a relatively small number of hectares but the yields have been projected at a much higher growth rate than those for corn, beans and rice.

7) In the survey questionnaire, researchers and extension agents were asked about the adoption rates for research results, if there were no extension service. The majority of answers was that technology adoption would occur at a much slower rate and would cover a smaller area. The conclusion is that reasearch without extension would also bring about a lower level of benefits. Evidently, the extension environment varies according to the product and the region. Both the large commercial producers on the coast and the rice producers in the jungle try to keep informed and to get the new technologies directly from the researchers. For them, the extension service has less impact than for the small farmers in the highland and the jungle.

8) The internal rates of return on investments in research and extension estimated for 1981 to 1996, given in Table No. 67, show that the same level of return (and perhaps a higher level for corn, wheat and rice) could be obtained if the present research and extension programs were to continue at present levels for the next six years. In the five product total, the internal rate of return would be 47% higher if the present programs were continued, since the research and extension programs of the future could be developed with heavy investments made beginning in 1980. The high returns predicted for initial investments are in a way the result of the transfer and adaptation of technologies generated by the International Centers for Agricultural Research. The investments in the national research and extension service have created a mechanism which permits transfer and adaptation of the technologies to the specific characteristics of Peruvian agriculture.

9) The expenses of research and extension should be considered as investments and no as consumer spending. As with other investments, the benefits derived from investments in research and extension are received after a period of time, but they are also subject to depreciation. The maintenance of research and extension programs over a period of time is important because new technologies depreciate as insects and diseases evolve and become more resistant or attack new varieties. The new results of research and extension should be continually produced on the basis of results previously obtained.

10) With the possible exception of education, the high rates of return on investments in research and extension calculated by the study would be difficult to find in any other sort of public investment, either in the

agricultural sector or any other sector of the Peruvian economy. However, the study expected to find even higher returns on research and extension, especially for corn, wheat, beans and potatoes, given that the yields for these crops were relatively low before the National Programs were begun. It is probable that the diversity in environmental conditions found in the country, the limitations of human resources and the increased purchase of modern resources required to obtain the benefits of the new technologies have been the causes that have kept the projected rates of adoption somewhat low. In particular, it is probable that the level of education among farmers, in terms of elementary and seocndary education, and particularly the lack of training of extension personnel (sector representatives) have been some of the most important limitations to the transfer of new technologies. But at the same time, the rates of return presented by the study also include to a certain extent the benefits on investment in training recently made by the NAIRP.

11) Many of the benefits of research and extansion are indirect in nature and therefore are not explicitly reflected in the rates of return. Thus, for example, there might have been a string savings in foreign exchange in the case of corn, wheat and rice. Likewise, for products that are imported or exported, in the measure that production increases, there will be some market pressure to reduce the price. This will tend to stimulate a greater level of employment in the rural sector, in the measure that the new technologies are not capital-intensive by nature. Many of the new technolgies produced by the NAIRP National Programs are principally biological and require as much or more work than present technologies.

12) The distribution of benefits on investments in research and extension between producers and consumers depends on the magnitude of the price reduction resulting from increased production. For imported goods such as wheat and corn, producers are the direct beneficiaries of increased production. The same occurs in the case of rice that is imported or exported; producers would tend to be the greatest beneficiaries of increased production. But if there is excess rice which is not exported, the consumers will be the principal beneficiaries if the government allows the prices to be reduced for both producers and consumer. If the government does not allow rice to be exported and allows the price to be reduced only for consumers, both consumers and producers would be directly benefitted, but the costs of the subsidies for the government and for society in general would be very high.

13) Contrary to what occurs with wheat, corn and rice, potatoes and beans are not internationally marketed in Peru. The adoption of new technologies for potatoes and beans could generate increased production, which in turn could significantly reduce prices. As a result, the benefits to the consumer could be substantial while the benefits for the producer could be negative, unless domestic consumption in the production unit can be considered to be a benefit. Those producers who are first to adopt new technologies will receive greater benefits than others, since they will be able to sell their products before the total production increases, thereby causing lower prices.

14) The distribution of benefits to the producer by region and by size of the production unit is also strongly influenced by the type of product. For example, the benefits of rice will be principally enjoyed

along the coast and in the jungle. The benefits to bean and potato producer will be greater for the large production units on the coast than for the small production units in the highlands. The benefits of wheat will be received by different size production units in the highlands, while the benefits of corn will be principally given to the large irrigated production units on the coast, and to a certain extent, to small dry crop production units in the highlands and jungle. Part of the benefits received by the small producers, especially in the highlands will be the result of domestic consumption.

15) The adoption of new technology will also mean increased demand for agricultural resources and credit by farmers. There will also be increased demand for food products, especially if the real per-capita income is increased by more than the 1% that the analysis projected for the future. Increases in population and real per-capita income magnify the importance of research and extension projects, in the sense of developing and promoting the adoption of new technologies which increase food production at prices attractive to consumers. Without generation and transfer of new technolgies, the only alternatives left to Peru are the importation of food (at a very high cost in foreign exchange) or a reduced food supply. In the latter case, the consumer will have to pay a higher price, or the subsidies to producers and consumers will mean higher direct costs to the government and to society at large.

16) Several questions as to the administration of research and extension also arise from the analysis of the study. Is the NIARP assigning its resources correctly by doing so in a proportion of 2 for extension and 1 for research? Is the distribution of resources for research and ex-

tension among the ARPCs near the optimum distribution? The same question may be asked about the assignment of resources among the National Product Programs and the National Production System Programs (highlands and jungle). How will production systems be affected (combination of crops) by the adoption of new technologies? How will the variations of income at the level of production units, the demand for credit, water, labor and other resources be affected?

17) In order to answer those questions, the study mentions some of the studies of the present evaluation study of research and extension. For example, it mentions that an analysis of lineal programming has begun to verify the influence of new technologies on crop combinations, variations in income and the demand for credit, labor, water and other resources. Also, it says that the effects of price policies with respect to the adoption of new technologies will be evaluated. The response functions for specified crops, beginning with experimental data, will be estimated, in order to examine the response of production to several levels of resources, with or without new technologies. Efforts are also being made to verify the availability of temporary series of aggregate agricultural production and for resources in Peru. If the data that are expected have sufficient quality, function analyses will be carried out for aggregate production and profit finctions, to verify the relative contribution or research, extension and education to agricultural production in Peru.

The study will also estimate the influence of research, extension and education on the demand for resources and in returns of scale. But if these data do not have sufficient quality for the study, an analysis of

production function at the micro-economic level will be made, using the data from production units, in order to verify the impact of research, extension and education..

2.3 Other Studies and Methodologies of the NIARP National Agroeconomic Program

2.3.1 Methods for the calculation of costs and profits under inflationary conditions and for analysis of risk and comparative agricultural technologies

This study, developed by the National Agroeconomic Program (NAP) and published in Novemebr, 1984, had the following objectives: 1) to propose models for the generation and collection of NIARP agroeconomic data through the NAP and the Offices for Agroeconomy and Rural Commercialization; 2) to propose a methodology for the calculation of costs and profits expected under inflationary conditions; 3) to propose a methodology for comparative analysis of costs, profits and risk for agricultural technologies; 4) to indicate the manner in which the users of agroeconomic information and analysis procedures may have access to proposed methods of analysis.

The objectives were designed taking into consideration that information collection, as well as the methodologies for expected costs and profits under inflationary conditions and the comparative analysis of costs, profits and risk for agricultural technologies require specific procedures in each case.

For the calculation of costs and profits under inflationary conditions, the NAP has deisgned and put into effect a computer program called PROCIN.

The program has been designed to calcutlate costs and profits under an ad-hoc theoretical model. PROCIN, which is written in BASIC, may be used to 1) Calculate ex-post costs and profits with monthly resource prices; 2) calculate ex-ante, using projected monthly prices; 3) make sensitivity analyses (simulation) of costs and profits, and 4) create a data base with information on resources and prices for each technology. To be used, PROCIN requires the following information: 1) descriptive data such as name of the crop, dates for sowing and harvest, place, etc.; 2) annual or monthly rate of interest; 3) rental value of land; 4) monthly data with respect to the quantity of resources or raw materials used, according to the activity in which they are used, such as land preparation, sowing, etc.; 5) monthly price data as to resources and crops; and 6) quantity produced and unit sale price. The information required is to make ex-post calculations. If ex-ante calculations are preferred, the data as to interest rates, prices of resources and products would have to be projected with respect to the inflation rate for the following period. Thus, regression models can be used by providing historical information with respect to the inflationary evolution of each resource or raw material to make predictions for the following period. These estimates can be made using the regression analysis routines contained in the SPSS/PC statistical analysis package.

For the comparative analysis of costs, profit and risk of agricultural technologies, the NAP has accepted and put into operation a computer program called Comparative Analysis Program for Alternative Technologies (CAPAT)*. The program is adjusted to an ad-hoc theoretical model both

* The CAPAT program was originally developed by Dr. Elmar Rodrigues da Cruz, of the Brazilian Enterprise for Ahricultural Research - EMBRAPA and installed by by him in the NIARP Computer Center in 1984.

for risk analysis and technology comparisons, using probabilistic criteria. As with the PROCIN program and the SPSS/PC, the CAPAT program is running on personal-style microcomputers installed in the NIARP central office and in the ARPCs which have received this equipment.

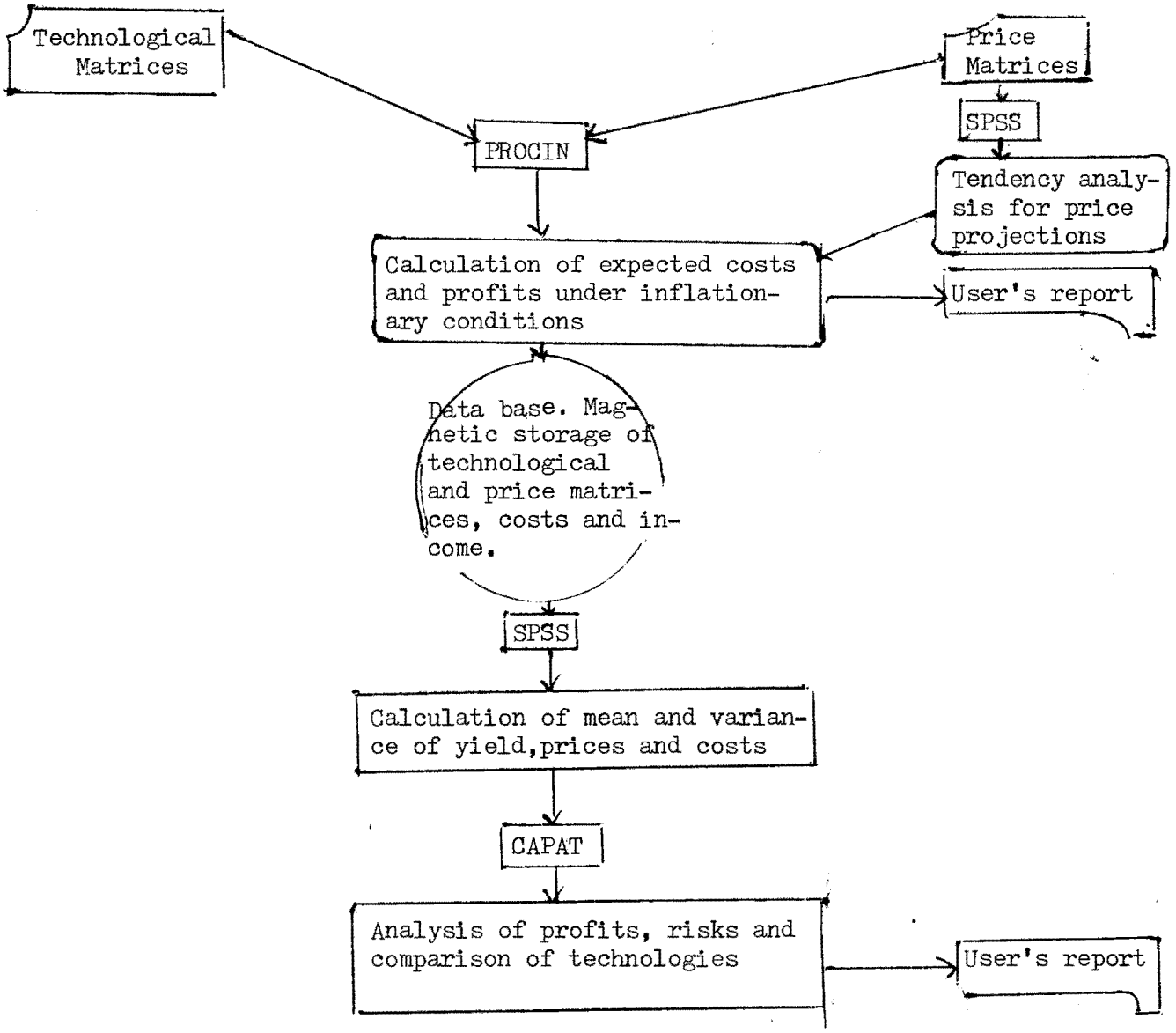
The CAPAT program, which is written in FORTRAN, may be used for: 1) risk analysis of agricultural technologies, given that for any particular technology, the program calculates the probability of obtaining net negative income and the respective confidence interval; 2) to compare two technologies, the CAPAT program uses the criteria of "efficient portfolio selection, with quadratic and cubed profit functions" and makes the comparison automatically. In this case, technology comparisons are also carried out according to a probabilistic method.

To use the CAPAT program, the following information is also required: 1) Name or title of each technology to be analyzed; 2) for each technology, production data, product price, costs which vary with yield and other costs. For each one of these items, the values can be introduced under any of the following options: 1) a known value; 2) an average value and its respective standard deviation; 3) a minimum value, a most frequent value and a maximum value; 4) rate of inflation, if there are differences in the vegetative cycles of the crops being compared.

Figure No. 7 presents a general model of the diverse components of the calculation system for costs and profits under inflationary conditions, and comparative analysis of profit and risk for alternative agricultural technologies, in which the integration and existing interrelations between PROCIN, SPSS and CAPAT can be seen.

The analyses of costs, profits and risjs in agricultural technologies

Figure No. 7. Flowchart of the Components of the System for Calculating Costs and Profits under Inflationary Conditions, and the System of Comparative Analysis of Profit and Risk for Alternative Agricultural Technologies



are facts which support the tasks of research and extension. With respect to research, these analyses allow the economic feasibility of the technologies in development to be identifies. In the case of extension activities, all viable technologies which can be recommended for their agronomic behavior will be economically evaluated before they are disseminated and promoted. The computer programs developed and the analyses made show the tremendous potential they have for ex-ante analysis of new technologies (before they are widely implanted) and the importance they have for program feedback and research projects. In addition if it is determined that a technology for a crop has great agronomic potential, it can be analyzed at different crop and resource prices . This will help to identify specific promotion policies, either for crop or resource prices, or for investments which contribute to technological change.

2.3.2 Preparation of investment projects at the production unit level

The process of decapitalization of agriculture in Peru began in 1970; it is a relatively well-known phenomenon. If sustained development of agriculture is really desireable by means of technological change, it is also necessary to provide for long-term capitalization. In order to provide the lements of judgement necessary for the agricultural producer to make decisions with respect to investment at the level of his production unit, a model to order and manage information that allows him to estimate the possible future yield of the investment is necessary. Thus, the study carried out by the NAP, published in April, 1985, entitled "Preparation of Investment Projects at the Farm Level" presents a methodological guide to the managing and ordering of information about an agricultural production unit in which a greater flow of financial

resources is expected to improve agricultural production and provide a yield for the resources, in order to capitalize the production unit.

In its second portion, the study presents a methodology and examples of the application of simulation techniques to assist in the decision-making process as to the assignment of resources for production in agricultural units. The study uses the MULBUD* program, which is a computer program designed to support economic evaluation of production units, where annual or permanent crops are grown. Through analysis of agro-economic information, technical production coefficients, cost of repurces, availability of labor and prices of the final product, agricultural budgets are obtained for mono-crop situations or associated production systems. All these relations are given in physical and monetary terms (costs and prices). The structure of the behavior relations give as results the cost elements (total budgets) and the yield on spending done in the production process. These results will be the elements which allow the farmer to make decisions with respect to future investments. But, in addition, the farmer and the researcher can experiment with the results of the system by modifying production factors (availability of labor, size of the production unit), the structural relations (change of technology, represented by changes in the technological coefficients) or in the product of the system (increase or decrease in unit yields). In this manner, the elements of risk and uncertainty are incorporated; sensitivity anaylsis permits the effects of changes in the system - such as changes in prices, yields or costs, according to the expectations of

---

1.MULBUD is derived from "MULtiple BUDsets" and was developed by the Development Studies Centre, National University of Australia.

of the farmer and/or the researcher/analyst. The experimentation can answer the question "What if...?", which cannot be done with a real system. Therefore, the study is also a powerful instrument for ex-ante evaluation of new technologies, but in association with the individual characteristics of each agricultural producer, with respect to the availability of resources and materials, and administrative capacity, and in association with the economic environment of absolute and relative proces within the framework of which the farmer carries on his activities. In addition, it offers the farmer a methodological instrument which will allow him to decide a priori on the convenience of seeking a long-term capitalization credit from the bank. The bank will also be in condition to analyze the payment of the loan and the possibility of recuperating the investment.

B. External Evaluation

1. External Evaluation of the REE Project

From January 7 to February 3, 1984, an external evaluation of the AID project for Agricultural Research, Extension and Education (No. 527-01992) in Peru, also known as the REE Project, took place. The evaluation, which was already planned as part of the follow-up and evaluation of the project itself, was carried out by five persons.*

* The evaluation team was directed by Dr. Morris D Whittaker, Director of the Office for International Programs and Studies,and Associate Professor at Utah State University. Other team members were: David W, Jame, Professor of Edaphology and Biometeorology at Utah State University; Dan C. Galvan,

The evaluation team identified various unforseen and unexpected factors during the first stage of the REE Project, 1980 to 1982, which were unrelated to the Project's Descriptive Document. These factors have indeed had an important impact on the project itself. With respect to this, the evaluation mentions the following factors:

1) The consolidation of the NIARP with the National Extension Service. One of the adverse results of the decision to consolidate was the delay in the implementation of the REE Project (The project agreement was signed in August, 1980, but was not implemented until January, 1982). In addition, there was a period of confusion and uncertainty related to the recent creation of the NIARP and the development of Agricultural Research and Promotion Centers (ARPC) throughout the country, as well as with respect to policies, procedures, regulations, administration and personnel assignments. In other words, the REE Project began late, because it required a definition of NIARP objectives and policies, new structures and procedures, all of which were different from what had been anticipated by the Project's original Descriptive Document.

2) The new investment projects of the World Bank and the Interamerican Development Bank. In the time lapse between the REE Project's approval by AID and March, 1982, two new investment projects were designed and ap-

---

District Director of the Agricultural Extension Service, Texas A and M University; George W. Norton, Assistant Professor of Agricultural Economics, Virginia Polytechnic Institute and State University, and José Valle-Riestra, Director General of the International Potato Center.

proved to support the development of the Research, Education and Extension System in Peru. At the end of 1981, the Special Project for the Agricultural Sector Program(SPASP) was approved; it is financed by the I.D.B., through a loan for $5.5 million dollars to Peru, $26 million of which were earmarked for the NIARP. In September, 1982, the World Bank Investment Project was approved; it was financed by a $40 million dollar loan and a national matching contribution, also to support the NIARP. Both projects were designed for the development and strengthening of the Research, Education and Extension System in Peru, and essentially had the same goal as the AID Project. In consequence, the total of loans, donations and national contributions approved for the development of the REES in Peru was $121 million dollars.

In August, 1982, the Director of the NIARP requested that the head of the North Carolina State University missio take on the responsibility as consultant to the World Bank Project. As a result, the head of the NCSU mission and its consultants helped to develop a national operation plan for the improvement of the REE System, which included the AID Project, the World Bank Project and the IDB Project in an integrated whole, thereby eliminating duplicated efforts and fixing geographic limits or jurisdictions for each individual investment project (See Map no. 1). All of this caused a great change in the original AID Project, which became part of the national REE System, jointly financed by AID, the World Bank, the IDB and the Peruvian government. The original AID project became part of the National ARPC System, including the majority of the elements, concepts and priorities proposed in the Project's Descriptive Document. How-

ever, the National System is larger, in terms of geographic area, projection and financing. The National Production Systems Programs, the ARPCs and the Regional Laboratory Services and Training became an integral part of the $121 million dollar project to be implemented throughout the country, arther than being limited to the original $15 million dollar AID Project.

3) The change of authority and direction of the Institute. With the creation of the NIARP, there was a change in the direction of the National Research and Education System, which caused considerable modifications in its organization, objectives and priorities, as well as a new perspective on the REE project different from the one which existed in the institutions which made up the NIARP (the NIAR and the National Extension Service). The new directors of the NIARP had not participated, at least not directly, in the elaboration of the basic study for the System, nor in the Project's original Descriptive Document. The fact probably caused some modificiation in the original project. For example, the role and resources originally planned for the National Agrarian University (NAU) were changed and reduced (although they were later substituted by a World Bank loan to the NAU). The National Administration Unit, planned in the original project, was never created. The NIARP was actually administering research and extension, while the NAU administered education, naturally including all its research components. Finally, there was no formal integration in research administration, as had been originally proposed.

The principal general recommendations of the external evaluation of the REE project were the following: 1) prolong the project until December, 1986 and provide additonal funds and technical assistance for the project, in order to assist the NIARP to coordinate the AID, World Bank and IDB loans. The additional technical assistance would be a human resources consultant and the continued presence of a consultant in agroeconomy; 2) begin preliminary planning for a second phase of the National REE System immediately. To this end, the following recommendations were given: a) that a single project be jointly developed by the institutions involved; b) that a joint administrative mechanism be found; c) that a minimum of five years be dedicated to the second phase, between 1987 and 1991; and d) that a division of labor be stipulated for AID and the World Bank. AID would provide technical assistance, training and some operating costs; the Bank woul provide necessary assistance in the formation of physical capital, such as vehicles and equipment. 3) Begin immediate identification of alternatives for long-term financing of NIARP operational costs.

The evaluataion provided a series of recommendations classified by areas-research, extension, education, institutional growth and development. The main short-term recommendations were: 1) to continue working closely and in coordination with the International Agricultural Research Centers; 2) to strengthen the ties of cooperation with the NAU and reginnal universities; 3) to strengthen the National Cereals Program; 4) to begin development of a national support unit for research; 5) to develop a computerized service for quantitative methods and analysis; 6) to insist on the creation and strengthening of a National Agricultural Library; 7) to

strengthen relations between NIARP's National Agroeconomic Plan and the Ministry of Agriculture's Agricultural Policy Analysis Group (APAG). In 1984, and the first months of 1985, the majority of the recommendations were implemented.

2. The World Bank Evaluation

In January, 1985, a World Bank Supervisory Mission visited Peru, in order to evaluated the Aricultural Research and Extension Project, financed by the Bank. The Mission was impressed by the process of Project implementation in the five ARPCs in the northern part of the country. Likewise, it concluded that the Visit and Training System had been quite well established and implemented with respect to the physical facilities, that the operating budgets were quite reasonable and that there was permanent technical contact with the farmers and that the training programs were correctly organized and implemented. The Supervisory Mission also verified that the research programs had been implemented or were being implemented, according to the original planning. The Mission gave special recognition to the progress recently made in the National Program for Andean Agricultural Systems, with respect to production unit level research projects. The Mission also recognized that the implementation program for the physical capital of the five northern ARPCs was well done, although improved administrative effectiveness is expected as the result of implementing the Project of Agricultural Planning and Institutional Development (APID) in the NIARP.

3. Institutional Evaluation by the ISNAR Mission

During June and July, 1985, at the request of the Director of the NIARP, a mission from the International Service for Agricultural Research (ISNAR)* visited Peru to evaluate the institutional model for research, extension and promotion that is being used in the NIARP. The objective of the evaluation was to inform the Peruvian government about the research, education and extension model used in the NIARP, as to its effectiveness, in order to focus on research and extension problems that limit agricultural production. Therefore, the mission did not only have to study the NIARP and its functions, but also the nevironment in which it operates. After analyzing certain aspects such as the country and its agricultural sector, the structure of the research-extension service, the research projects, human resources, international technical cooperation, and making an analysis of the NIARP's institutional model with that used by other Latin American institutions for generation and transfer of technology, such as the Brazilian AgriculturalResearch Company (EMBRAPA), the Colombian Agricultural Institute (ICA), the Institute for Agricultural Science and Technology (INTA), of Argentina, the National Institution for Agricultural Research (INIAP), of Ecuador, the ISNAR mission classified its conclusions and recommendtaions, acoording to the following:

*The mission was directed by Dr. Floyd Williams, Principal Researcher for ISNAR, and included Drs. Jens Christensen, Extension, and Eugenio Martínez, Research Consultant. Dr. José Toledo, Director of the Tropical Grasses Program, CIAT, also assisted the mission part-time.

1) NIARP function. By combining the functions of research and extension in a single organization, assigning its available resources to a few National Programs, emphasizing agroeconomic research that provides the necessary information, so that farmers and those responsible for economic and farm policies can make decisions, the Mission concludes that the NIARP is in a strategic position to serve Peru and her agriculture well. It suggests that the NIARP take responsibility for the entire research and extension program in the whole country, and in order to do that, it needs the suuport of the entire research community. It concluded that it was logical that in its first years the NIARP was principally preoccupied with its own development, but that the moment has come to widen its vision and really become the leading institution in the National Research and Extension System. The Mission also suggests that in some cases, such as sugar cane, cotton and grapes, the role of the NIARP should be to assists in production and to help agroindustry to organize itself for the research and extension activities it needs. Specifically, the Mission recommends that "the NIARP be retained as the national focal point for the development and dissemination of agricultural technology in Peru". In addition, it also suggests that the NIARP activities and programs reflect the role of the leading national institution in all agricultural research and extension and the NIARP accept its mandate to assure that agricultural research in Peru be identified, planned and executed, the results published and the technology made available to its clients".

2) Integral relations with education. Once the NIARP accepts its new role

as the center of the Peruvian research system, the Mission also mentions that until now, the NIARP has worked to promote its own human resources- an interest which should be maintained - but that it is also necessary to widen this interest to include all public sector researchers and extension agents, especially those in the universities. Therefore, the NIARP should assist the universities in formulating personnel development plans and assists them in finding the resources needed to implement these plans. It also mentions that another facet of integration in the complete incorporation of educational personnel of the universities into the research system. Peruvian universities, especially the NAU, have the greatest concentration of the scarcest resource in Peru - trained research personnel. Therefore, it is essential that university professors become involved in research, because they keep themselves up to date in their professional areas and can pass this information on to their students. The graduate students should also dedicate their research to real problems, which could make an important contribution to national needs. Specificially, the Mission recommends that: "the complete integration of the research capacity of the universities and other institutions belonging to the public sector into the research system".

3) Institutional relations. The Mission identified and graded the relations developed by the NIARP with other national and international agencies, and found positive aspects. These links have permitted a very important access to the flow of internation components of technology, including information, varieties and germoplasm that can be used in Peru. The links

have also permitted the access of NIARP technicians to the International Agricultural Research Centers and their training activities. The Mission also found praiseworthy NIARP's active participation in the Cooperative Support Programs for Research in Tropical Soils and Lesser Ruminants,, since it provides a direct technical relation with many universities in the United States and a number of other countries around the world that share common scientific interests and questions.

4) The National Programs. The Mission concluded that the integration of the research capacity of universities and other agencies which make up the research system may take on various forms, but that the most important would occur in the national research on the crops involved in the National Product Programs, since it is the most efficient manner of organizing research in the major crops. According to the Mission, the five crops that presently make up the NIARP's National Product Programs have been identified in numerous opportunities as the most important for Peru, and they are also closely related to the international scientific community. These links need to be strengthened in the differenr national institutions. The Mission suggests that the annual planning for the National Programs be widened to include all available scientific talent, including University scientists and those in other private or public agencies. The report suggests "supporting the National Product Programs, since it is expected that they will provide a flow of improved technology for the chosen crops in the coming years", The Mission also recognizes the priority that should be given to the National Livestock Program, but also mentions that the physical facilities and experienced researchers in live-

stock are not found in the NIARP, but in other institutes and in the universities. Taking this into consideration, the Mission recommends that "The Livestock Research Program be developed and implemented by a leading institute or university, using all available public and private resources". But is also recognizes that the extension function in livestock should be accepted in the NIARP, and that in some zones, it is important to include specialists in animal production to the NIARP extension service. Likewise, the Mission recognizes that the agroeconomic part of the Livestock Program should be planned under the direction of the NIARP National Agroeconomic Program and that most of the research on agroeconomics can be efficiently carried out by NIARP field personnel, but that it is also necessary to include university professors in this activity.

5) Agroeconomics. The Mission concludes that the NIARP's National Agro economic Program is truly exceptional and that few countries have recog-- nized as clearly the need for a flow of economic and social information based on research and directed toward its various clients, especially producers and those who formulate agricultural policy. The Mission suggests that this activitiy be maintained and widened to the production unit and community levels, in order to keep users constantly informed as to the costs and benefits of each technological component as part of each National Product Program. The same type of information should be collected, summarized, analyzed and presented to the institutes that develop agricultural policy in aspects that affect both production and agricultural development. Specifically, the Mission congratulates the NIARP for the development

of its National Agroeconomic Program and mentions that, "it must be maintained and its support increased, especially in terms of training for present personnel". As with the other programs, the Mission concludes that linking the Agroceconomic Program with the universities and other public and private institutions will bring more talent to the research program and reinforce both the quality of research and the attention given to this discipline by professors and students. The Mission also suggests a careful review of the literature available on different methods for exante evaluation of the costs and benefits of alternative investments in research.

6) Jungle and highland programs. With respect to these two new National Programs, the Mission suggests that the NIARP proceed cautiously. It mentions that the Jungle Program should concentrate its activities on reinforcing the research capacity already in existence and channel the technical components through the extension network also in existence, whether its zone of influence exist : in or out of the jungle's zone of influence. Therefore, the major role of the program will be that of coordination, assuring that the program does not duplicate efforts and that the resources assigned are essential for coordination. The Highland Program an area where development has been difficult in the past and where the complexity of the economic and cultural circumstances in the highland communities indicate that the NIARP should implement this program as a pilot study.

7) Choice of an extension model. The Mission identified and recognized that the agroclimactic and socioeconomic variations in the different zones

of Peru are so great that the extension methods and operation modes must change from zone to zone. The Mission suggests that Peru be divided into eight zones of agricultural environments, each one with its own special group of producers and apllying a different extension focus. Although it recognizes that eight zones do not entirely cover all of the country's agricultural conditions, the Mission notes that they will absorb all available physical, financial and human resources. The eight zones are: 1) food producers on the coast; 2) producers of industrial crops on the coast; 3) commercial farmers in the highlands; 4) communities in the upper regions of the highlands; 5) farmers in the lower jungle; 6) commercial producers in the jungle piedmont; 7) areas corresponding to the Special Investment projects; 8)mono-crop programs.

The Mission mentions, "Just as it in necessary for technology to adjust to the needs and circumstances of the users - and therefore, must vary according to agroecological zones and the recommended areas - the methods used for technology extension must also vary according to the technology itself, the relative level of management used by the client, the available mechanisms to promote it and the availability of goods and services that facilitate its adoption. When the extension systems and methods are adapted to local conditions, this helps to guide research programs and to stimulate the demand for improved technology, creating an efficient road for communication between those who use the technology and the research ers".

8) Organization of research at the local level. The Mission recognizes

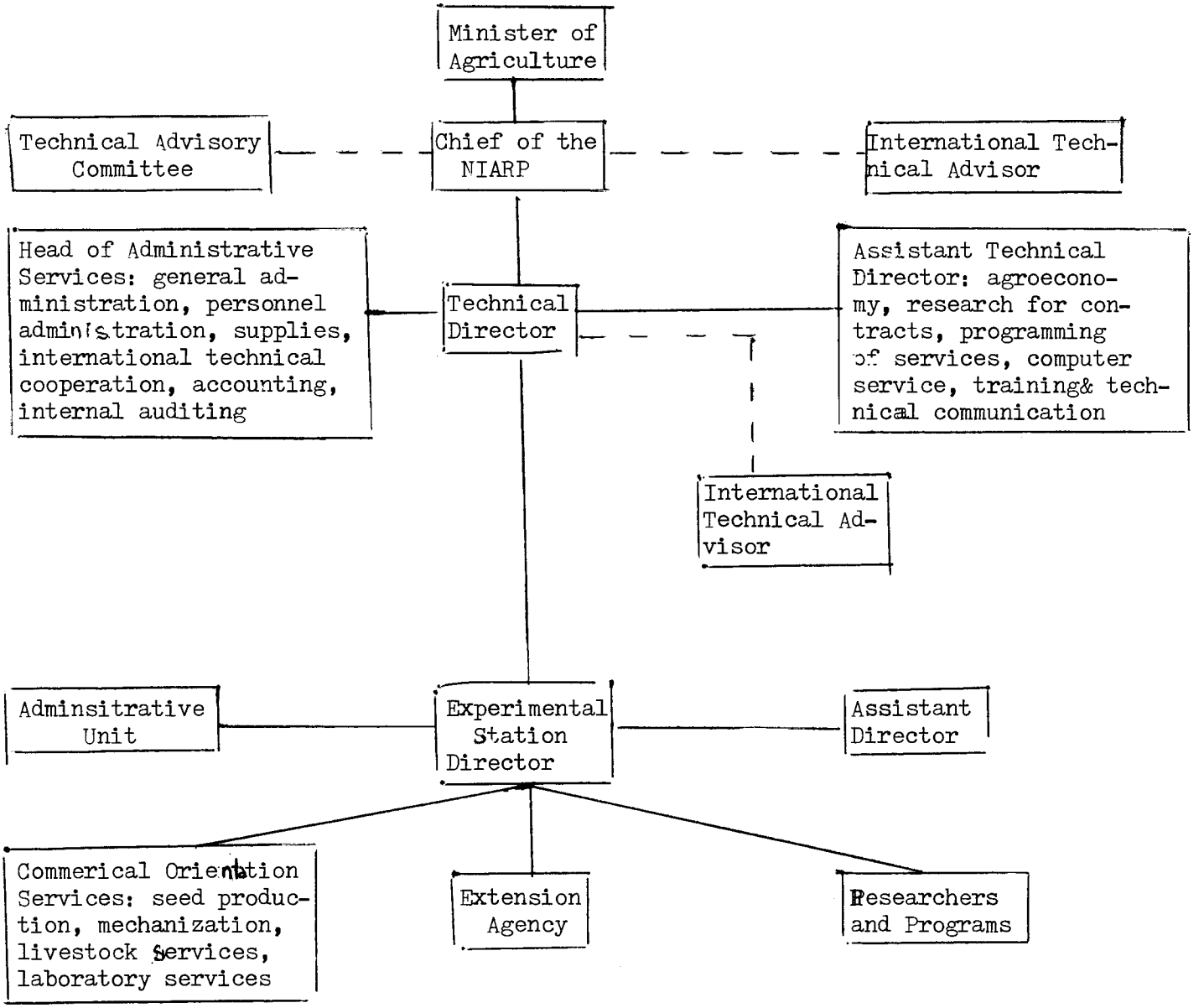
that the research-extension combination, as the NIARP has managed it, is highly recommendable and should be maintained. Although different methods are used, research and extension are so interdependent that they need to be integrated at the user level in order to be effective. The the production unit level, the test of new technology is the last step in the process of research and the first step in the extension process. By sharing the responsibility for these tests, extension personnel will understand the new technology better and will provide the researchers with an idea of the producer's circumstances and needs. The Mission recognizes that the NIARP has developed the link between research and and extension in a satisfactory manner. However, it also considers that making the political divisions between the Departments the basis of the research and extension services organization at the local level much less efficient than an origanization based on agroecological zones. One of the most important recommendations that the Mission gives in this area is that Peru "concentrate its development on the minimal essential network of Experimental Stations to serve the major agroecological zones when resources are available, and that the stations be used as the central focus for local research and extension".

9) Administration of the Experimental Stations. The Mission recognizes that "the processes of technological development and dissemination are guided principally by the problems and opportunities of clients. These processes should be carried out in response to the needs of producers without considering the political party in power. The person in charge of research and extension in a region or a country must be a scientist, ex-

tension agent or competent administrator". The Mission also recommends that "the Directors of the Experimental Stations, who will be the Research and Extension Directors at the local level must be selected on the basis of their administrative and technical capacities, and named as career civil servants for agricultural research, not subject to political appointments".

10) Director of the NIARP. On this topic, the Mission recognized that the three directive positions in the NIARP (the Chief and the two Executive Directors) are subject to political appointments and recommends that "Given the technical nature of research and extension, the National Director of Research and Extension should be a career civil servant, not subject to political appointments". In addition, it mentions the NIARP's need to integrate its activities with those of several external organizations and to coordinate research and extension activities more and more. It suggests that the NIARP re-roganize its directive level. The Mission's perception is that the Chief of the NIARP should have a vision of the world outside the Institute, bringing the experience and knowledge of this world to the Technical Director, who should be responsible for the internal functioning of the NIARP. The Directors of the Experimental Stations would be under the authority of the Technical Director, who would also have a minimum administrative staff and an Assistant Director. The Mission specifically recommends that"the national NIARP leadership be invested in one Chief and one Technical Director (See Figure No. 8).

Figure No. 8. ISNAR Proposal for NIARP Organization



11) NIARP Personnel. The Mission verified that the NIARP had inherited personnel from several organizationa and that part of them do not have the necessary experience or capacity to carry out the Institute's programs. Also, and perhaps as a result of personnel transfer from different organizations, or excessive bureaucratic procedure and superposition of organizational units, it seems that the NIARP has many more people than it actually needs. Therefore, the Mission suggests that a study be made of available personnel for research and promotion, a study which began at the same time that the NIARP did, but which needs to be broadened to include personnel from other institutions in the public sector, especially those from universities. Specifically, the Mission suggests that,"NIARP complete its personnel study, broadening it to other Peruvian institutions". It aslo recommends that "the NIARP be permitted to use the services of an external agency which would indicate the minimum essential personnel for research and extension (including necessary experience) that will be required in the next five to ten years, using the research programs and their objectives, and the extension activities in each area as a starting point".

4. Evaluation of the National REE System

Between September and October, 1985, and Evaluation Mission visited Peru; it had been recommended by the Board for International Food and Agricultural Development (BIFAD), financed by an AID contract and carried out as a folow-up to the Base Study for the Agricultural Research, Education

and Extension System*. The principal objective of the Mission was to evaluate the viability and effectiveness of the National Agricultural Research, Education and Extension System's service to Peruvian agriculture and to suggest long-term strategies (to the end of the century) for support of the System by the main international institutes financing it. After describing the National REE Systems, and evaluating its performance during recent years, the Mission gave a series of conclusions related to the System's achievement and its limitations. In general, it was estimated that the National REE System after 1980 had shown, in a very short period, considerable progress and growth. Also, it considered that one of its most important acheivements was the conceptualization of the System, which had emerged from a national research, education and extension strategy, based on two principal institutions,the NIARP and the NAU. During the period in reference, there had been a rapid recapitalization of the System with respect to its physical capital and that important steps had been taken for the development of its human capital, It also noted that there was clear evidence that the National REE System was already producing the desired effects, especially in the oldest systems and that through technological packages there were already several significant increases in the indices of production and productivity. Finally, the Mission concluded that the relationships between the Peruvian institutions making up the National REE System, especially the NIARP and the NAU, with the International Network for Agricultural Sciences, had improved greatly and had been increased as well as formalized in number and objectives. With reference to the principal problems and limiting factors of

---

* The Mission was directed by Dr. Morris D. Whittaker and included Drs. J. Clark Ballard, Specialist in Agricultural Development; Arthur J. Coutu, Agricultural Economist; John A. Pino, Specialist in ResearchAdministrattion and José Valle-Riestra, Research Specialist. Dr. Stephen Oilver, Specialist in Macro-economics, also assisted the team.

the Ssytem, the Mission identified, first of all, the lack of sufficient well-trained human resources, as well as mentioning that in addition to the lack of quality, there was also an excess number of personnel assigned to the NIARP, Secondly, it mentions a groups of macro-economic policies that produce distortion in the incentives given to farmers. The principal problem is that the incentives offered are significantly reduced by the combined effect of the macro-economic policies, to the point that the prices received by producers do not even cover the production costs. Also, the personnel and salary policies followed by the government had made the salaries received by the administrative and technical personnel in the System relatively low compared to other alternatives in the national private sector, and with other possibilities in the private and public secotrs internationally. Thirdly, another of the probelms related to the structure of the NIARp was that its research and probably its extension system was divided into too many experimental stations and sub-stations, given the limitations of trained human resources and lack of operating funds. Fourthly, the Mission identified the problem of the fragile relationa among the institutes making up the system, and mentioned the following: relations between the public and private institutions of the REE System; between public institutions in the System and private institutions; between public institutions in the System and the process of

economic and agricultural policy formulation. Finally, a generalized lack of System credibility was found, whose consequence was most evidently seen in the lack of adequate financial support that the System receives from the government.

Before presenting its recommendations, the Mission defines a long-term strategy for the National REE System, The principal elements of the strategy are the following: First, given that human resources are the most critical to the System, the strategy should promote the training and retain within the System the best scientists and technicians. Secondly, given that research and extension would have a very small impact on agricultural production if there were no incentives for adoption of technologies designed to increse production, economic and agricultural policy should develop an adequate set of production incentives. Thirdly, strong integration and correlation between the various components of the programs and institutions which make up the National REE Systems should ne sought. Fourth, the programs presently underway should be consolidated and proliferation should be avoided. Fifth, relations and mutual cooperation with the private sector shourld be promoted and strengthened. Sixth and last, more emphasis should be given to the transfer of improved technology, such that less time is need to receive the expected return on investment in research, education and extension.

The recommendations given by the Mission which have been principally directed at the international institutions supporting the National REE System, and strongly based on the strategy given, are as follows: First,

the institutional development of the NIARP should be consolidated through greater investment in technical assistance, training, operational support and physical capital. Second, the research and training activities carried out with regional universities should be strengthened and better articulated. Third, Cooperative participation between the NIARP, the National Agrarian University and the regional universities in planning and implementing the REE programs should be stimulated. Fourth, the process of technology transfer should be accelerated and strengthened. Fifth, the capacity of the NIARP in aspects related to water manaement and use should be developed. Sixth, the participation of the private sector in the REE system should be encouraged.

VII. ANALYSIS OF THE SITUATION: PRINCIPAL CONCLUSIONS AND RESULTS

It is a well-known fact that one of the problems that most dramatically affects developing nations is insufficient agricultural production, especially of foodstuffs, to supply the internal demand of the growing population. It is also known that there are two ways in which total agricultural production can be increased: through the expansion of the area under cultivation, or by increasing the productivity of the land in regions where traditional agriculture is practiced. The first method is known as horizontal growth of production and the second as vertical growth in production. Evidently, the two are complementary, but not mutually exclusive. The problem that normally appears is the decision as to the degree of intensity that should be given to each. Those responsible for the management of economic and agricultural policy in each country must define, with the greatest degree of precision possible both with respect to the efforts and investments of the public sector in agriculture and complementary activities and the type of incentives to be offered to the private sector, in order to reach the objectives proposed.

The policy of expanding agircultural boundaries, or horizontal growth, is characterized by the following: 1) From the political and geoplitical points of view, as well as that of national security, the occupation and colonization of the agricultural boundary is truly important. 2) It encourages the development of science and technology for the conquest of the agricultural boundaries and of regional markets, as well of agroindustry. 3) It increases the regional capacity for creating new jobs and a demand for

appropriate technology. 4) It is a highly expensive policy, since it requires a large investment per unit of area, in order to construct the necessary infrastructure. 5) It requires considerable government intervention and the search for funding from abroad. Implementation, organization and adminsitrative activities are really complicated. 6) While public investments (especially of external resources) are really high, the internal rate of return on these projects is quite low. In the majority of cases, the direct beneficiaries of the project will never be able to pay the total investment. In general, the cost of the project is paid by society as a whole. Given that these projects are located far from the markets for materials required and products produced. the costs of energy and transportation increase rapidly. 8) the growth of the agricultural boundary has very specific requirements with respect to technology and labor.

In contrast,the policy to promote the growth of agricultural production, or vertical growth, through science and technology, has the following characteristics: 1) It economizes land and other resources, to produce greater quantities of the same product or other products. 2) It saves time,because by increasing productivity, agricultural production grows more rapidly than the agricultural boundary. 3) In general, it permits production at lower unit prices (greater efficiency in production because the average production costs are lower), which benefits both low-income consumers and producers at the same time. 4) Indirectly, it helps combat inflation and increases the level of competition among countries in the international market. 5) it encourages development in the national markets for materials and products and

the majority of the benefits remain in the agricultural sector, thereby promoting general development of agriculture. 6) It does not require large public investments at a single moment in time. On the contrary, it requires agricultural credit for annual production and for capital formation. Since loans will be repaid, the banks can make new loans and money will flow quickly. Since the majority of the money required comes from internal funds, it does not reuire foreign financing, which in turn, increases the foreign debt of developing nations. 7) It requires a formal committment in the sense that public and provate investment in agriculutral research, extension and education must continue in the long term. Around the world and under diverse conditions, it has been proven that the return on these investments is very high. In the majority of cases,the returns have been higher than those of any other type of investment. This indicates that these investments are the "best business" for society, but it also indicates that the level of investment is still far below the optimum level. 8) It requires the existence of an "agroeconomic policy" that will induce and promote technological change in agriculture through a) the development of an efficient national industry dedicated to the production of modern materials (improved seeds of the high yield variety, fertilizers, correctors,"appropriate machinery", etc.); b) the administration and management of relative prices in favor of agriculture, rather than discriminated against it; c) opportunities for available credit for yearly management and for capital formation in agriculture; d) development of a system of agricultural insurance to reduce the risks of production and the market; e) development of a wide-resching information system, in order to decrease the level of uncertainty in agriculture; and f) an orgainzation of farmers in order to increase their

education in agriculture and their general level of training, thereby increasing their ability to negotiate in the materials and product markets.

The arguments presented show that there are favorable and unfavorable factors both for the exoansion of agricultural boundaries and for the increased productivity of the land. But there are also arguments and reasons that go beyond an exclusively economic analysis. The need to occupy territory and to diminish the pressure for land and the accompanying social tensions are examples of arguments that are difficult to analyze from an economic standpoint. Furthermore, faced with a situation of decreasing rural population and less economic activity in the rural areas, as well as increased care for natural resources, the expansion of the agricultural boundary will necessarily have to take place with the support of science and technology, always taking into condiseration that growth in productivity of the land should be associated with increased productivity in labor.

It is also evident that there is a technical-political conflict between the two policies. Technicians and politicians have very different views as to the assignment of human resources. Generally, the technicians, due to their formation, exaggerate the imprtnace of increasing productivity and minimize the imprtance of expanding the agricultural boundary. The politicians generally do exactly the opposite: they want immediate results and think that increasing productivity requires more time than they have in office, and that the traditionalism of the rural areas would be a barrier to new knowledge and to the modernization of agriculture. For them, it is much simpler to follow the experience of the past, which has already shown how to transform

natural resources into agricultural land. Today's problem is that the conquest of the agricultural boundary must be done with strong support from science and technology, in order that resources be exploited in the most technical manner possible, in addition to maintaining ecological stability and economic feasibility. However, this alternative still has a high political pay-off that makes the assignment of resources and public funds for construction more attractive. For example, new irrigation projects are very expensive, but they have dams, channels, highways and other physical aspects which can all be blessed and have ribbon-cutting ceremonies. Sustained, long-term growth of productivity of land does not offer the same political pay-off. For example, the annual growth in corn yield of 300 kilograms per hectare, or increased wheat yields of 200 kilos per hectare over a ten-year period, despite the fact that its economic and social pay-offs are higher than any public investment, will never be the cause of a ribbon-cutting ceremony, or a single blessing.

The Peruvian case is particularly clear. With a very small agricultural base of only three million hectares cultivated yearly (which include permanent cultivations, grasslands and cultivated forests) and with a total population of nearly 20 million, today has a land per capita rate of 0.15, which is one of the lowest in the world. The FAO Production Yearbook for 1980 estimates a world land per capita rate of 0.33 The agricultural sector in Peru considers that the land area presently cultivated will not increase significantly in the next 15 to 20 years. In any case, any increase will eventually be compensated for by the hectares that stop pro-

ducing each year, as the result of salinization, erosion, desertification, natural disasters, etc. On the other hand, estimates by the National Population Council indicated that between the years 2000 and 2005, the total population of Peru will have reached 30 million. At that moment, the land per capita rate will have been reduced to a value between 0.10 and 0.11. With serious limitations to expanding its agricultural boundaries, with a growing and proncipally urban population (due to the high rates of rural-urban migration observed in the past and the present, and which all seems to indicated that high rates will continue for the nexy 10 to 20 years) and with a production base that will remain constant in the coming decades, it is evident that Peruvian agriculture has to seek the most rapid road to technification, rapid technological change and greater technical and economic efficiency in production.

The diverse external evaluation studies of the PIAR investment projects, as well as those carried out by the National Research, Education and Extension System, which have been presented in this study, indicated the evidence that in the years from 1980 to 1985, there has been great effort on the part of the public agricultural sector to plan and implement research, education and extension policies in Peru. In particular, the efforts of the public sector have been reflected in a series of mechanisms and actions, that although they have sometimes been somewhat disorderly and dispersed, have led to the creation and functioning of an informal national research, education and extension system in Peru. In addition, the effort of the public sector has also been reflected in the activities and

achievements of the National Institute for Agricultural Research and Promotion, which were also discussed in this paper. But, although the characteristics of Peruvian agriculture and the growing population are already known to require additional efforts, it is also evident that the efforts of the public sector from 1980 to 1985 have not been sufficient. Given the political, social, economic and financial situation of the nation, additional efforts could only be made by the public sector with the greatest of difficulties, due to its limitations for human resources, physical capital and operational resources. Therefore, an active and effective form of participation by the provate sector in research, education and extension activities must be found, in order to complement the activities of the public sector, and thereby contributing to the sustained development of Peruvian agriculture. However, it is estimated that in the same period from 1980 to 1985, the participation of the private sector in research, education and extension activities was quite limited, despite the existence of a series of legal measures designed to promote, organize and regulate these activities. Evidently, this legislative effort has not been sufficient and must be revised. Especially, given the process of decapitalization suffered by Peruvian agriculture beginning in the decade of the seventies, legislation on aspects of credit assistance which would really bring about a recapitalization of agriculture must be totally revised, perfected and widened. The legislation must promote, favor and permit public and provate investment in long-term capitalization credits, in consideration of the fact that the characteristics of agricultural activities are also long-term. Public and private research in Peru has

generated (and continues to do so) technology designed to increase productivity and production of some long-term agricultural activities, which are presently not feasibile for farmers because of the lack of a capitalization credit policy for agriculture. The following examples should be sufficient: genetic improvement of milk and beef cattle, as well as of ovines and South American camelids; instruction in technology to improve cultivated grasses; technification of the infrastructure and methods for irrigation and drainage; fruit-growing on the coast and fruit-growing and forest cultivation in the jungle region; improved physical infrastructure in production units through the installation of fences, stables, small dams, wells, agriculutral machines and implements, small agroindustry, etc. In all of these activities, today's investment can be recuperated only after several years. If there are no facilities for capitalization credit, technological change and modernization are practically impossible.

It is also evident that the efforts of the public sector in research, education and extension activites undertaken during the last five years should continue, always concentrating of those activities with a high social return. The diverse studies presented in this paper, especially the evaluation studies using internal rates of return, have, for example, shown the high social returns of the National Product Programs carried out by MIAP. The study also shows that it is possible to achieve even higher rates of return if the investments of the public sector continue at the same level for at least the next six years. Therefore, the support of the public sector for these programs should continue, becoming more effective every day, in the measure that the products are produced and con-

sumed all through the country, that they are the basis for the general population's food supply, that they are produced fundamentally by small and medium size farms in depressed areas and that they most benefit low income consumers. In other programs, which will be mentioned later, the public sector should propitiate and promote increasingly active and effective participation by the private sector in research, education and extension activites.

In Peru, there are three types or models of organization in the private sector which, because of their make-up and characteristics, show the greatest benefits and most effectiveness in services rendered. They are farmer's organizations by valley, organizations by products and private, non-profit institutions. These organizations can be an excellent complement to government activity in agricultural research and promotion. With certain initial legal, technical and financial assistance, in addition to the respective bureaucratic facilities, these organizations can rapidly become self-supporting in research and extension for specific valleys and products. Among farmers organizations by product, poultry-raising is an excellent example of the participation of the private sector in research and promotional activities. The impulse that this sector has had is due in large part to the private sector's interest and capacity for initiative to promote its own technological and economic development. This has been achieved by importation and rapid adaptation of new varieties with increasingly higher rates of conversion of food to products, because of improved sanitation, management and coomercialization. As has been mentioned, the sup-

port of the public sector in legal and technical aspects, as well as in initial financial support, this example could be multiplied in other organizations by products or by regions (valleys). This is the case for cotton, sugar cane, grapes, fruits and vegetables in the coastal region; coffee, cocoa, tea and other industrial crops in the jungle. Cattle, pork and sheep-raising, the production of tropical fruits and forest products should follow the same path, as should agroindustrial research and promotion, especially with reference to agroindustrial transformation of food for conservation, preservation and consumption throughout the year. These activities should be strongly encouraged by the private sector, and supported by the public sector. The demand for these products - both nationally and internationally- will undoubtedly make the participation of the private sector in the search for new technologies attractive. It could be a source of clear and rapid returns and benefits, if the government were to propitiate and promote the generation, transfer and adoption of such technologies by supporting legislation and specific measures in economic and agricultural policy.

1. Utilization of the results of the internal evaluation studies

1.1 Most important users

With reference to the results of different internal evaluation studies presented in this study, it is evident that, to date, the most important "institutional user" has been the PIAPP itself, and to a lesser degree, its collaborating institutions. The utilization of the results of internal evaluation presents the following characteristics: The follow-up information and research projects which make up part of the National Plan

for Agricultural Research, developed in the second semester of 1984 and the first quarter of 1985, tested during the second quarter of 1985 and approved for implementation at the national level in July, 1985, still has not had time to show its most important results nor to be correctly evaluated, in order to reach its full degree of utilization. It is expected that in 1986 the first concrete results of the follow-up system for experiments and research projects appear. It is also expected that given its charcateristics of versatility, agility and effectiveness, the system will offer rapid, opportune and important information so that the authorities of the institution may immediately undertake corrective measures with respect to any experiment or research project that has been approved. The monitoring system is a highly useful instrument for the administration and management of agricultural research, whose fundamental objective is to seek the greatest possible efficiency in resources presently assigned and to maximize the use and returns on resources to be assigned in the future.

NEARP is also the greatest user of the results of the follow-up studies carried out by the Follow-up and Evaluation Unit of the Agricultural Research and Education Project, financed by the World Bank. The results of these studies allow for a much more precise notion of the characteristics of the participating farmers, of the farmers reached by dissemination and of agriculture in general in the regions where they have been carried out. This sort of information is very valuable for the definition of priorities for research and should be used in the yearly programming meetings of research activities. It is also an analysis of the efficiency and

effectiveness of the extension service itself, from the farmer's point of view. With this information, the institution has the elements required to make the necessary modification in the extension service activities, in order to improve its level of public service. The studies also permit an evaluation of the messages (about technology or production systems) that are transmitted to the farmer; this evaluation is made by the farmer himself, and thereby serves as feedback on the system, perfecting the process of technology generation.

The MIARP 1984 Annual Report was written to attract diverse groups of readers. From the internal point of view, the Report had two objectives: 1) to ensure that every person working in the Institute, at whatever level, has full knowledge of the Institute, its objectives, programs and activities and internal structure, so that each one will understand his important role in the Institute; 2) that by knowing about important institutional achievements, measured and quantified results and the important contribution that the Institute makes to Peruvian farmers and farming, each person who works in the Institute will feel proud of it.

From the external point of view, the Report also had various objectives and reached diverse groups: 1) To present to society in general the activities, advancements and achievements of the Institute in 1984, by means of the National Product Production Programs, the National Production System Programs, the National Support Services and Programs, the diversified Programs, as well as a group of production programs in which the MIARP participated, such as National Food Reserve and the Coastal Cam-

paign, Here, the Report's objective was to inform society in general what was done with the resources received. 2) to ensure that society knows the Institute's true objectives and to inform or clarify that the INIARP and the ARPCs are one and the same organization. In Peru, there is a problem of institutional identity with respect to research, extension and promotion, since the name INIARP is not well known at the regional level, while the ARPCs are very wll known. This identity problems is the result of the fact that the INIARP was created in 1981, and although the ARPCs were also created in that year, their image is related to other institutions that in the past has similar abbreviations (See Appendix No. 8, "Historical Summary of Agricultural Research in Peru to 1980). 3) The Report was also designed to reach a very important public - the most representative organizations of Peruvian farmers, so that they would know more about the Institute's activities and achievements. Therefore, the Repport was designed for Farmer's valley and product organizations, for the National Agrarian Organization and the most important agricultural enterprises, including cooperatives and Agricultural Societies for Social Interest, Indian communities and peasant communities, among others. 4) The Report also attempted to reach agroindustrial enterprises, distributors of agriculutral materials and non-profit private institutions that work in the rural sector, such as the Rural Institute for the Canete Valley, the National Development Foundations, New Technological and Social Strategies, among others. 5) Evidently, the Report was also designed to inform other national institutions in the public sector, especially those in the agricultural sector, such as the Ministry of Agriculture,

the Sectoral Office for Agrarian Planning (SOAP), the Sectoral Office of Statistics (SOS), the General Directors of Agriculture and Livestock, Agrarian Reform and Rural Communities, Agroindustry and Commercialization, Water, Soil and Irrigation, Forest and Fauna; the National Institutes for Increased Agricultural Areas, Forest and Fauna, Agroindustrial Development, all of which form part of the agricultural sector. Also,it was designed foe the Executive and Legislative branches of the government. In particular, it was directed to the Ministry of Economy and Finance, and its diverse sections, to the Ministry of Industry, Commerce, Tourism and Integration, to the National Planning Institute, the National Institute for Developments and all its Special Development Projects, to the National Office for the Evaluation of NaturalResources, the Agrarian Bank of Peru and all associated banks, to the Higher School of Business Administration, the National Institute for Public Administration and the General Comptroller of the Republic. 6) The university system and associated institutions for science and technology in Peru made up a very special part of the audience. The report was directed to the National Agrarian University, the Pacific University and all the regional universities with schools of agriculture, to the Veterinary Institute for Tropical and Highland Reserach, to the National University of San Marcos, the Institute for Research in the Peruvian Amazon, the National Council for Science and Technology and the College of Peruvian Engineers. 7) Finally, the Report was also designed to offer information to multilateral or bilateral international institutions that maintain cooperative relations with the NIARP. Among them, the following may be mentioned: the institutes that finance NIARP Investment Projects with loans and donations, such as the

AID, the World Bank and the Interamerican Development Bank; the international Potato Center, the International Center for Corn and Wheat Improvement, the International Center for Tropical Agriculture and the CATIE; the Interamerican Institute for Agricultural Coorperation, the FAO and the International Association for Atomic Energy; the Canadian Agency for International Development and the International Development Research Center; the Japanese Agency for International Cooperation and the GTZ, of the Federal Republic of Germany; to other International Centers for Agricultural Rsearch located outside Latin America, such as the International Food Policy Research Institute, the International Service for National Agricultural Research, The International Board for Plant Genetic Resources. There are also other governments and their respective cooperative agencies such as Canada, Holland, Japan, Great Britian, the Federal Republic of Germany, New Zealand and the Financial-Technical Cooperation of the Swiss government, There is a group of American Universities which cooperate intensively with the NIARP, especially North Carolina State University; others include the University of California (Davis), the Virginia Polytechnic Institute and Stae University, Iowa State University and the MIAC, which is made up of advisory institutions for the Agricultural and Institutional Development Planning Project, Utah State University and Yale University. Finally, but no less important are the fellow institutues of the NIARP, which also carry out agricultural research and extension activities in Latin America, especially the Colombian Agricultural Institute; the National Fund for Agricultural Research, of Venezuela; the National Institute of Agricultural Research, of Ecuador; the Bolivian

Institute for Agricultural Technology; the Brazilian Enterprise for Agricultural Research; The Cacao Research and Development Center and the Campinhas Agronomic Institute, both of Brazil; The National Institute for Agricultural Technology, of Argentina; and the National Institute for Agricultural Research, of Chile.

The evaluation study of the net economic benefits of the National Agricultural Research and Extension Programs, done by Norton and Ganoza, had the major objective of verifying the importance, needs, convenience and priorities of NIARP investments in agricultural research and extension activites in the five National Programs whose products are basic to the diet of the Peruvian polpualtion. Evidently, since the investments that the NIARP makes in the activities come from diverse national and international sources of financing, the public which was hoped to be reached by the study was made up of those responsible for the institutions or agencies that provide sources for financing. With respect to national institutions and agencies, the objective was to reach high-level decision-makers in the following institutions: the Ministry of Agriculture and its dependencies, the Ministry of Economics and Finance and in particular, the Regional Directors of Public Budget and Credit, the National Planning Institute, the National Institute for Development, the Executive branch in general, the Congress of the Republic, especially the bicameral Budget Commission, the Agricultural Commission, the Economics Commission, and the Permanent Congressional Commission. Due to its methodological contributions, the study was also directed, for training purposes, to the Peruvian universities

with Colleges of Agriculture, Social Sciences and Economics. Also, it was directed to other national institutes for science and technology.

In the international environment, the study hoped to reach all of the institutions and sources of financing (loans and donations), as well as training and technical assistance institutes that collaborate with the NIARP. But in general, as information, the study was also designed to reach all the public and private institutions mentioned previously in the section which referred to the NIARP's Annual Report for 1984.

1.2 Planning of Research and Resource Assignment

As has been mentioned previously, the results of follow-up systems and studies of research activities are partially used for the planning of future research. Thus, during the programming meetings, a review is made of projects underway and new projects are presented. These activities do not yet have a systematic nature, in the sense that not all projects underway are reviewed, but it at least represents an attempt to improve future planning. When the follow-up and monitoring system for experiments and research projects established in 1985 is implemented fully, there will be the necessary and sufficient conditions for research planning in the following year(s) to be based on a much more solid and permenent foundation.

With respect to the assignment of resources for research, this can be

divided into two parts: assignment of resources to the institution and assignment of resources inside the institution. The results of diverse evaluation studies and activities undertaken by the NIARP to date, permit it to be affirmed that they have been partially used in order to obtain new resources for the Institute. For example, the principal comparisons and results presented in the 1984 Annual Report and the internal rates of return estimated by the Norton and Ganoza study for NIARP's National Programs for the first semester of 1985, doubtless contributed to the fact that the head of the Institute used them in July, 1985, to achieve the Bicameral Commission on Budget and Permanent Credit's and the Permanent Congressional Commission's approval for two supplementary credits for the AID and World Bank Investment Projects for a sum of nearly 90 billion soles, or $7.5 million dollars, at that time.

However, with respect to assignment of resources within the Institute, there is no available information about the use of the results of follow-up and evaluation studies, reports and activities being used, or at least in the proportion that would theoretically allow for the optimum use of economic and social resources. From the theoretical point of view, a higher rate of return is an indication that the activities which have produced it would also generate the greatest social and economic returns. But at the same time, it also means that to date the institution has been investing below the optimum social and economic level in research.

1.3 Research Administration and Limiting Factors

To date, it cannot be affirmed that the evaluation reports and studies have contributed to or have been fully used for the administration of agricultural research in the NIARP. Potentially, the conditions for using the results of evaluations studies as input exist. However, it would require more detailled and elaborate information in order to ensure greater confidence in decision-making as to administration and guidance of human, physical and financial resources (and genetic resources in the case of a research institution), and their assignation by programs and by regions. Obviously, more information and studies are needed. In particular, there are many expectations as to the monitoring or follow-up system for research experiments and projects, since it could be a useful tool for improving the administrative efficiency of research

There are some limitations that have affected both the application of follow-up and evaluation methodologies and the use of the results. The following may be mentioned: 1) The initiation of the follow-up information system for experiments and projects forming part of the National Agricultural Research Plan was difficult at first, probably because of the lack of experience in defining the method(s) most adequate for the objectives. After a long period of research and study, using and adapting models used by other similar institutions in Latin America, especially from the Brazilian Enterprise for Agricultural Research, the difficulties were solved and the system was finally implemented in July, 1985.

There were also some initial difficulties with respect to the computer system - the most adequate hardware and software for the follow-up system - and and trained personnel for programming, processing and execution, both in the central office and in the ARPCs. These difficulties were also solved during 1984 and 1985 by training personnel in biometry and quantitative methods, by hiring necessary personnel in specific areas and by acquiring the equipment necessary for the central office and branch offices, and the purchase and/or development of appropriate software. 2) In the Follow-up and Evaluation Unit of the World Bank Project, there were also some difficulties, especially with respect to the amount and timing of the financial respurces needed for the Unit's operation and for carrying out its studies. 3) It is estimated that the greatest difficulties found in the application of the evaluation methodology by means of economic excess and for the calculation of the internal rate of return on investments in research and extension made by the NIARP were related to data collection. This is especially true in the case of secondary data, since up-to-date information was not available on price-elasticity values for demand and income elasticity of demand for rice, corn, beans, potatoes and wheat. This made it necessary to use information from 1972 on elasticity of spending and money flexibility in order to calculate the other data indirectly. 4) Another factor that has also limited the use of the results of evaluation studies has been the lack of training among personnel and the lack or poor timing of financial resources in order to define and execute an aggressive institutional policy of public relations for the dissemination of research results. 5) Finally, but no less important, it is estimated that a general limitation that affects

both the application of follow-up and evaluation methods and the evaluation of research with respect to the use of research results has been, and still is the salary structure, the low general salary level and a general lack of training of personnel working in these areas.

2.Use of the Results of External Evaluation Studies

The "institutional users" of the external evaluation studies are the NIARP and the institutions that provide financing (loans or donations) for its investment projects. All of the external evaluation missions that have visited the NIARP have always found the doors open for available written material and in many cases thay have obtained verbal information through interviews. The National Institute has always been open to all constructive criticism from the Missions and the recommendations are always seriously considered for later implementation, since they are made by experts in administration and institutional development of agricultural research and extension agencies.

To date, most of the recommendations made by the external evaluation missions have been accepted and implemented. Frequently, the implementation of the recommendations is not done word for word, but are adapted to the characteristics and idiosyncracies of the Institute as human, physical, financial resources and time permit. Therefore, it may be concluded that, in general, the external evaluation missions that have visited the NIARP in the last two years have contributed decidedly to strengthening the institution from the standpoint of its internal admini-

strative structure and to improving its image. With respect to this last point, the recommendations made by the mission reports, because of their neutral character, constructive and favoring no side in particular, have served as a "vote of confidence" for the development of the projects and NationalPrograms, but, more importantly, they have strongly backed the strategic and political importance of the institutional model and the enormous potential for benefits which can be derived from strengthening and developing the most important activities. The conclusions and recommendations of the external evaluation missions have also been used by the Institute authorities to promote and project a better image in the national public sector in general and in the public part of the agricultural sector in particular, seeking the political support and financial backing needed to strengthen and develop the Institute.

However, some factor have limited the full use of the results of external evaluations. But in general, they have been exogenous factors. For example,the changes made in administration and national economic policy (over which neither NIARP nor the institutions which finance its investment projects have control) have thus far impeded the approval and implementation of the second stage of the REE Project, which was planned for implementation between 1987 and 1991.

VIII - RECOMMENDATIONS

In this section, some suggestions and recommendation are presented, with which it is hoped that not only will the present methods of evaluation of agircultural research be improved, but that they will also improve institutional relations with other organizations that are also interested in agricultural development and especially in evaluation of agricultural research activities.

A. Internal Evaluation

1) Accelerate the process of implantation of the follow-up or monitoring information system for agricultural research, in order to verify its efficiency and to perfect it by successive approximations through time. It is suggested that the system should be implemented three times yearly, at the end of Febrary, June and October of each year. Once the system is perfected, it should be officialized and approved as the only follow-up system for information and the evaluation of agricultural research in the NIARP, using the most convenient legal methods to real this goal. The other mechanisms which were reported in Section III are stiil valid, but they do not have the periodicity, flexibility nor the versatility of the system implanted in July, 1985.

2) It is understood that the Follow-up and Evaluation Unit, including its structure, human and financial resources and its program of activities,

exist as the result of an agreement between the government of Peru and the World Bank, which was signed in 1982, as part of a financing agreement of an investment project. It cannot be known whether the follow-up and evaluation activities of the Unit duplicate activities carried out in other NIARP dependencies. But the situation would doubtlessly improve if it were suggested to the World Bank that the idea is not to create new structures, but to strengthen existing ones. The ideal would be to integrate the stucture of the Follow-up and Evaluation Unit, including its resources and program of activities, into the Office of Agroeconomy and Rural Commercialization, thereby strengthening the institutional structure and also indirectly reinforcing the National Agroeconomic Program.

3) As part of the overall concept of follow-up and evaluation, a new mechanism, the formulation of an Annual (or Final) Report for each project, should be introduced. The same format may be used for the Annual Report as for the Final Report. The Annual Report Form should be presented for those projects still underway and the Final Report Form for projects that have ended or have been canceled, The objective of the Annual Report is to receive and evaluate information on the flow of activities planned for the project, from its initiation to the date of presen of the Re - port. Other charaderistics of the Annual Report should be: a) It should be presented in the annual evaluation meetings for research projects; b) It should be accumulative in nature. For example, if a research project has been underway for two years, the report should include information on activities for both years; c) It should present partial results

of the project, using graphs, figures and tables to facilitate the presentation whenever necessary. Also, it should discuss the results obtained and their relationships with the project objectives. For those projects which have not yet produced results, the researcher should offer comments on the possibilities of obtaining satisfactory results in the future; d) The Annual Report should also relate project activities in the area of technology dissemination which has actually taken place, mentioning what information was given, how, when and to which target group; e) According to technical norms, the Report should also present a list of the publications produced as a consequence of the project; f) The Annual Report also is a means of registering the alterations which have occurred in the original project formulated. All changes should be registered accumulatively. They might refer to the project location, its experimental design, deadlines, equipment, strategies, costs, etc., but there should be no modifications with respect to title, problem, objectives or hypothesis of the original project; g) Based on the information or observations resulting from the research project, the Annual Report should mention other research projects that could be conducted as a complement to the project, or other areas of interest for research.

The Final Report should also be presented in the meeting for project elaboration, or on the date given for the finalization of the project, according to the original project format. In the case of finished projects, the objective of the Final Report is to give a formal end to the activity, removing it from the National Research Plan. In the case of cancelled projects, it is also important that there be a Final Report ,

in order that the Institute's administration have sufficient knowledge and elements of judgement to know why the project was cancelled and to take corrective measures for the future. The minimum content of the Final Report should be the following, with the specificied charactertistics: a) With respect to the results, conclusions and recommendations, the Final Report should refer to the problem, objectives, hypothesis and methodology of the original project. It should describe the data obtained, using charts, figures and graphics, according to needs. It should discuss the results obtained by the project and the relation to the objectives. It should also present final conclusions on the research done. The project conclusions and recommendations should be written clearly and precisely, but it should also be clear that the presentation of the Final Report for a project does not exclude the possibility nor remove the researcher's responsibility of producing a technical publication of the research carried out; b) The Final Report should also list the dissemination of technology actually carried out,mentioning the activity, how, where and to whom the information was given; C) With respect to publications,the Final Report should also list all of the publications generated from the research results obtained, according to the respective technical norms.

4) As part of the concept of follow-up and evaluation of agricultural research, the Institute should also introduce the concept od a "Technology BanK", for all new technology generated. This concept simply implied maintaining an updated technological invesntory. It can really be useful, not only for researchers, but also for extension agents, social scientists, economusts and Institute authorities, as well as other

similar public or private institutions, farmers associations, individual farmers, etc. The main objective of the Technology Bank is to inform the target groups mentioned and the public in general of what has already been produced in terms of agricultural technology. Internally, and for the benefit of the Institute, and for other public and private institutions for agricultural research, the system will be used to prevent duplication or repetition, since it can inform as to what has already been produced, who produced it, how, where and when the technologies were generated. In addition, it is also important to know what has not yet been produced in agricultural technologies for each crop, National Program, region, etc. The system should be computerized and thus needs an ad-hoc form for collecting information. There should also be an established annual periodicity for collection and publication of information.

5) Continue with the necessary support for the normal activities of the Socio-economic Evaluation of Research and Extension in Peru, part of the National Agroeconomic Program, financed by AID. The institutional support necessary should come from both NIARP and AID, and its continuity depends on the approval and financing of the second stage of the Investment Project for Agricultural Research, Education and Extension, planned for the 1987-1991 period. This effort should be concentrated, in order to finish the lineal program analysis that has already begun, in order to examine the influence of new technologies on possible crop combinations, income variations and the demand for credit, labor, water and other resources, as well as the effect of price policies for resources and products on the adoption of new technologies. Another component of the project that needs to be

finished is the estimation of response functions for individual crops, using experimental data, in order to examine the production responses at different levels of resources, using new or old technologies. Also, efforts must be made to obtain data on temporal series for agricultural production and resources in Peru, in order to carry out the study of an aggregate production function or an analysis of the profit function, in order to evaluate the relative contribution or research, extension and education to agricultural production in Peru. This project would also estimate the influence of agricultural research, extension and education on the demand for resources and on scale returns. Thus, for example, this study could verify the impact of research, extension and education not only on product supply,but also on the demand for labor, mechinery, fertilizers, energy and other resources. In addition, the study could also compare the contribution of product and resource prices (and other fixed factors, such as the size of the production unit, the intensity of irrigation, capitalization of the production unit, and agricultural credit) for the same variables mentioned previously. Finally, the calculations necessary for an analysis of congruence and excess product for consumer and producer could be carried out, leading to the recommendations for the NIARP for decision-making with respect to the present and future assignment of resources to research and extension. In this way, the Socio-economic Evaluation of Agricultural Research and Extension Project would produce a high technical, economic and political pay-off, since its results would obviously contrinute to improving and increasing the amount and timing of financial resources provided the Institute. It would also assist in perfecting the mechanisms for assigning financial resources for

research and extension within the Institute.

6) It is highly recommended that institutional coordination between the NIARP and the Agrarian Bank of Peru improve; to achieve this, it is only necessary to put into full effect the presently existing agreement between to the agencies. In the specific case of evaluation of research results, coordination would refer to installing in the Bank's microcomputers the existing software of the NIARP's NationalAgroeconomic Program for the analysis and ex-ante evaluation of new technology. Specifically, we refer to the convenience of installing in the branch office and agencies of the Agrarian Bank of Peru the PROCIN, SPSS, CAPAT and MULBUD programs, as well as training Bank technicians and experts, so that when the farmer goes to the Bank to seek credit, the Bank may have some idea as to the yield and risks involved in the loan requested, as well as those related to the adoption of new technologies. Naturally, the Bank will also be interested in knowing a priori the probability of recuperating the loan requested. This improved coordination with the Agrarian Bank would allow for excellent feedback on agricultural research programs and projects undertaken bu the NIARP.

7) It is also necessary to recommend an improved degree of coordination with the National Agrarian University and other, especially the Pacific University. The objectives of improved coordination are: a) Training of technical personnel of the NationalAgroeconomic Program and the Office of Agroeconomics and Rural Commercialization at the NIARP; b) Utilization

of the capacity installed in the University, with respect to quality of teaching staff, library and computer center and availability of graduate students to make research evaluation studies;c) Evaluate, from the social and economic standpoints, research results obtained by the National Agrarian University and the regional universities with Colleges of Agriculture. By reaching these objectives, contributions will be made to the improved feedback ` the agricultural research system in Peru needs to become more efficient.

8) Establish or improve Cooperation Agreements with other agricultural research institutions, both public and private, such as the Veterinary Institute for Tropical and Highland Research, the Institute for Research in the Peruvian Amazon, the New Technical and Social Strategy, the Greater Canete Valley Rural Institute, the Foundation for Cotton Development, such that the research results obtained by these institutions can be evaluated from the social and economic point of view with the help of the NIARP's National Agroeconomic Program.

9) Finally, recommend to the NIARP dissemination media that the results, conclusions and recommendations of the Norton and Ganoza study be made widely known.

B. External Evaluation

1)A high authority in the NIARP or the Ministry of Agriculture, preferably

at the level of Executive Director, should be included among the members of the external evaluation missions. With this, various objectives would be achieved, among which the following should be noted: a) the Mission would have one reliable member who has a deep knowledge of the institution and its probelms, and can function as a permanent source of information for the other team members, as well as acting as the national representative; b)involve the national institution with the objectives, methodology, conclusions and recommendations of the mission; c) as a consequence of the first two objectives, the adoption of the mission recommendations be the institution being evaluated would be improved. The greater portion of the recommendations which have been goven by external evaluation missions thus far have been more specifically directed to the institutions that finance the project or provide technical assistance, than to the national institution itself. But even in the case when the recommednations are directed toward the national institution, there is the feeling among its authorities that the recommendations have come from a team that does not necessarily have the appropriate internal political support. By including a director of the institution on the evaluation team, this problem could be solved.

2) Related to the previous recommendation, it is also necessary to suggest a better "political preparation" for the evaluation mission before its trip. Thus, the institutions which provide financial and technical assistance and the NIARP itself should begin an a priori campaign in the upper levels of the Ministry of Agriculture and the Ministry of Economics and Finance, with respect to the importance of the mission, the

capacities of its members, the importance of its conclusions and recommendations for farmers, for consumers and for the agricultural sector in general and national agricultural economic in particular. In other words, firm political backing is sought for the mission before it arrives. The ideal situation would officialize this support through a Ministry Resolution, or even better, a Supreme Resolution.

3) It is also necessary to recommend, officialize and prioritize the principal conclusions and recommendations resulting from the external evaluation mission's report, especially those affecting the national institution. This officialization should be carried out by Departmental or Ministry Resolutions, depending on the case, such that the mission's recommendations are formally and legally approved, having all institutional and political support necessary to promote their rapid implementation.

4) Among the team members of the external evaluation mission, there should be at least one Latin American expert from a similar agricultural research or extension institution in Latin America, or from the Interamerican Institute for Agricultural Cooperation. Many times the problems in the agricultural research and extnsion environment in Latin America are more similar to those seen in other Latin American countries than in the United States or any European country and the solution found in some Latin American country for a specific problem may be the most viable and most rapid solution in the country receiving the evaluation mission.

5) The external evaluation missions should adopt the recommendations of

Norton and Ganoza study with respect to the most important directions, content, procedures and aspects of research organization, which should be considered by any external evaluation mission when reviewing the national research system (See Appendix 11). With relation to the content and procedures, Norton suggests that any review of national agricultural research should consider the folowing: a) the criteria on which the evaluation of the components of the agricultural research system is based; b) analysis of institutionall objectives, goals and prioritities; c) anaysis of institutional organization and its capacity for conducting and developing agricultural research programs; d) aspects of institutional administration, including planning, implementation and monitoring; e) analysis of the group of institutional relations, both in the horizontal and vertical directions; f) deep analysis of the number and quality of present research programs; g) whenever possible, quantitative evaluation of the impact of research programs on production, distribution of benefits, employment, nutrition,etc.; h) evaluation of the present and future needs of the institution with respect to the number and scope of research programs, its organization, facilities for administration, training, financing, etc. Finally, for the success of the Mission, Norton also recommends the inclusion of the following aspects: a) relations between the national research system and the International Centers for Agricultural Cooperation; b) the measure or priority in which the national research system should adopt research methods on production systems; c) the need to have a theory which orients the manner in which the national research systems should finction, recognizing historical, cultural, climactic, topographic, size, political and economic differences, as well as the long-term nature of agricultural research programs.

BIBLIOGRAPHY

AMAT Y LEON, C., D. CURONISY, La Alimentacion en el Peru, Centro de Investigaciones, Universidad del Pacifico, 1981.

BANCO AGRARIO DEL PERU. Ley Organica y Estatuto del Banco Agrario del Peru (en apendice incluye la Ley de Promocion y Desarrollo Agrario y su Reglamento). Lima, Julio de 1982. 119 pag.

BANCO INTERNACIONAL DE RECONSTRUCCION Y FOMENTO - BIRF. "Manual de Seguimiento y Evaluacion de Proyectos Agricolas y de Desarrollo Rural". Por: D.J. Casley y D.A. Lurij.

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL - CIAT. Revista Internacional. Resena de Investigacion y Cooperacion Internacional. Volumen IV No. 2, Cali, diciembre de 1985.

COUTU, A.J. y RAVEN, K. "Background paper on the national agricultural research, extension and educational system of Peru". Lima, agosto de 1985. 126 pag.

CENTRO PERUANO DE INVESTIGACION APLICADA. La Poblacion del Peru en el Ano 2050: Proyeccion, Ficcion o Realidad. Lima, 1984. 167 pag.

EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA - EMBRAPA. Departamento de Diretrizes e Metodos de Planejamento. "Rates of Return on EMBRAPA's Investments: total investment and physical

capital", by Elmar Rodrigues da Cruz, Victor Palma and Antonio Flavio Dias Avila. Brasilia, EMBRAPA-DID, (EMBRAPA-DDM, DOCUMENTOS, 1) 1982, 55 pag.

EVENSON R. "Consideraciones sobre Investigacion, Extension y Desarrollo Agricola". Conferencia presentada en la Universidad del Pacifico. Lima, 12 de setiembre de 1985. 14 pag. y anexos.

FRISCH, R. "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors". Econometrica 27 (1959): 177-96.

HINES, J. "The Utilization of Research for Development: Two Case Studies in Rural Modernization and Agriculture in Peru", Ph.D. Dissertation, Princeton University, 1972.

INSTITUTO NACIONAL DE INVESTIGACION Y PROMOCION AGROPECUARIA - INIPA. "Acciones y Logros del Instituto Nacional de Investigacion y Promocion Agropecuaria". Informe Anual 1984. Lima, 1985. 75 pag. y anexos.

INIPA. "Codigos para el Seguimiento de la Ejecucion de un Experimento". (Segun formato S. CPI-84.06). DIA-DEIA, Julio de 1985.

INIPA. "Formulario OBI.85.06 (y sus respectivas instrucciones), para el Seguimiento de Experimentos 1985". DIA/DEIA, Julio de 1985.

INIPA. "Guia de la Estructura Organica y Funcional del Nivel Central y Regional del INIPA". Oficina de Presupuesto y

Planificacion - Unidad de Racionalizacion. 6ta. Edicion 1985. Lima, enero de 1985. 219 pag.

INIPA. "Normas para la formulacion de proyectos de investigacion agropecuaria - Proyectos de Linea y Sub-Proyectos". Directiva de Organo No. 004-83-INIPA-DIA, agosto 1983.

INIPA. "Normas para la supervision y evaluacion de la investigacion agropecuaria". Directiva de Organo No. 03-83-INIPA-DEIA-DIA, enero, 1983.

INIPA. Oficina de Planificacion y presupuesto. Unidad de Seguimiento y Evaluacion. "Informe de la Encuesta de Seguimiento a Agricultores de Enlace del CIPA I - Piura". Lima, marzo de 1985. 22 pag. y anexos.

INIPA. Oficina de Planificacion y Presupuesto. Unidad de Seguimiento y Evaluacion. "Seguimiento de las Acciones de Extension y un Ensayo de Evaluacion en el CIPA IX - Cajamarca. Campana Agricola 1984 - 1985". Lima, noviembre de 1985. 99 pag. y anexos.

INIPA. "Plan Nacional de Investigacion Agropecuaria" - 1985.

INIPA. Programa Nacional de Agroeconomia. "La Extension Agricola en el Peru, 1981 - 1985". Por: Alfredo Mendivil. Serie: Apuntes Agroeconomicos No. 28-85. Lima, Junio de 1985. 14 pag.

INIPA. Programa Nacional de Agroeconomia. "Metodologia para Calculo de Costos y Rentabilidad bajo Condiciones de Inflacion y para Analisis de Riesgo y Comparacion de Tecnologias Agricolas".

Por: Faustino Ccama, Rolando Piskulich, Carlos Pomareda y Luis Quintanilla. Serie: Notas Agroeconomicas. No. 08-84. noviembre, 1984. Lima, Peru. 53 pag.

INIPA. Programa Nacional de Agroeconomia. "Necesidades de Politicas y Asignacion de Recursos para el Fomento de Productos en los Programas Nacionales del INIPA. Por: Luis R. Zavaleta Remy. Serie: Notas Agroeconomicas. No. 04-84. octubre, 1984. Lima, Peru. 74 pag.

INIPA. Programa Nacional de Agroeconomia. "Plan de Trabajo para 1984". Serie: Notas Agroeconomicas. No. 01-84. Abril, 1984. Lima, Peru. 21 pag.

INIPA. Programa Nacional de Agroeconomia. "Preparacion de Proyectos de Inversion a Nivel de Finca". Por Victor E. Merino Paredes. Serie: Notas Agroeconomicas. No. 08-85. Abril, 1985. Lima, Peru. 100 Pag.

INIPA. Programa Nacional de Agroeconomia. "Retornos a las Inversiones en Investigacion Agropecuaria: Revision de Metodos y Estudios para su Evaluacion". Por: Victor Palma. Serie: Notas Agroeconomicas. No. 10-85. Junio, 1985. Lima, Peru. 49 pag.

INIPA. Programa Nacional de Arroz. Documento Base, 1983.

INIPA. Programa Nacional de Cereales. Documento Base, 1983.

INIPA. Programa Nacional para el Desarrollo de los Recursos Humanos. Documento Base. Lima, 1985.

INIPA. Programa Nacional de Ganaderia. Documento Base, 1984.

INIPA. Programa Nacional de Investigacion y Promocion Agropecuaria en Selva. Documento Base. 1983.

INIPA. Programa Nacional de Leguminosas de Grano. Documento Base, 1983.

INIPA. Programa Nacional de Maiz. Documento Base, 1983.

INIPA. Programa Nacional de Papa. Documento Base, 1983.

INIPA. Programa Nacional de Sistemas de Produccion Andinos. Documento Base, 1984.

INIPA. Servicio Nacional de Laboratorios. Documento Base, 1983.

INIPA. Servicio Nacional de Semillas. Documento Base. 1985.

INIPA Y ASOCIACION ISRAELI DE COOPERACION INTERNACIONAL - AICI. "Metodologia para la Evaluacion de Acciones y Resultados en Extension Agricola". Por: Yoel Busel. Lima, Junio de 1984. 30 pag. y anexos.

INIPA y AICI. "Resultados de la Evaluacion en Algunas Agencias del CIPA XIV - Cusco". Cusco, Junio de 1984. 13 pag.

INTERNATIONAL SERVICE FOR NATIONAL AGRICULTURAL RESEARCH - ISNAR. "La Respuesta del INIPA a la Demanda en el Peru de Investigacion y Extension Agropecuaria". La Haya, Holanda, Julio de 1985. 94 pag.

NORTON G.W. "Reviewing Agricultural Research Systems". Trabajo preparado para la XIX Conferencia Internacional de Economistas Agricolas. Malaga, Espana. Agosto 28 a Setiembre 4, 1985. 8 pas.

NORTON, G. y GANOZA, V.G., "The Benefits of Agricultural Research and Extension in Peru", PAE-AP-15-85, Programa Nacional de Agroeconomia, Instituto Nacional de Investigacion y Promocion Agropecuaria (INIPA). Junio, 1985.

ORAM, P.A. and BINDLISH V., "Resource Allocations to National Agricultural Research: Trends in the 1970's," ISNAR-IFPRI, 1981.

PALMA, V. "Informe presentado al Ministerio de Agricultura". Lima, 22 de Julio de 1985. 34 pag.

PALMA, V. "Productividad o Expansion de la Frontera". Agro. Revista del Banco Agrario del Peru. Ano II, No. 3. Febrero 1985, pp. 10-15.

PALMA, V. "Resena Historica de la Investigacion Agropecuaria en el Peru hasta 1980". Lima, Marzo de 1985. 50 pag.

PAZ, L.J. y PUIGGROS, J. "Potencial y Posibilidades de la Investigacion y Extension Agropecuaria Privada". Lima, Abril de 1985. 31 pag. y anexos.

SUNDQUIST, et. al. "Measuring Returns to Research Expenditures for Corn, Wheat, and Soybeans". In: Evaluation of Agricultural Research. Minnesota Agricultural Experiment Station, 1981, p. 76-82. (Miscellaneous Publication, 8).

UNIVERSIDAD NACIONAL AGRARIA. Catalogo General. La Molina, Lima, Agosto de 1982. 186 pag.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT - USAID. "Evaluacion a Medio Periodo del Proyecto del USAID en Investigacion, Extension y Educacion en el Peru". Lima, Marzo de 1984.

USAID. Informe de la Mision de Evaluacion Externa del Sistema Nacional de IEE. Lima, Octubre de 1985.